BOSTON UNIVERSITY

COLLEGE OF BUSINESS ADMINISTRATION

THESIS

The Scope of Punched Card Accounting

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1.0 Introduction

1.1 The Mechanization of Industry

No other single factor in the progress of civilization has produced such forceful effects upon the lives of people than the substitution of electrical and mechanical energy in industry for the work of human labor. The Industrial Revolution began midway in the 19th century. The spinning jenny, the cotton gin, and the steam engine were created later. Edison developed the first electrical generating and distributing system, which he closely followed with the introduction of the incandescent light; Tesla perfected the first alternating current motor; Bell and Watson originated the telephone. These and other discoveries gave early impetus to the adoption of machines by industry to meet the demands of mass production. This was the period of growth of industrial giants and the era of production problems. While the first machine types were crude, with limited utility, devices were improved and perfected as time went by. The volume of production soared, output per worker increased, costs were lowered, and management became more efficient. From 1900 on, the replacement of labor by machines became more preponderant. The horse and wagon gave way to the automobile, the plough to the tractor, and the skilled workman to the machine tool. Today the domination of our wants and needs by the influences of the machine age is more complete than ever. Whole industries based on technological advance have rendered other industries based on manual occupation

obsolete. The registration office at Washington issues patents on new devices each year at an abundant rate. The pinnacle of scientific achievement is still far from being reached, although it is reasonable to believe that future changes measured by technological effects, will be less drastic than those of the past few decades. It is fitting to mention that although the lives of people are increasingly affected by machine activity, the standard of living is much improved and real wages have increased in the last two decades.

1.2 The Modernization of Accounting

The growth of small establishments into vast enterprises from concerns of local sphere to businesses of national and international importance was a natural result of industrial expansion. Sole proprietorships and partnerships became incorporated and groups of corporations were consolidated into hugh unified organizations. The enormously increased volume of business in large organizations created tremendous problems of internal management. The accounting routine of large business firms required early changes to cope with the tremendous growth in number of transactions to be analyzed, the expanded classifications necessary for providing management with adequate control, and the greater necessity for producing satisfactory results commensurate with the pressure of time, cost, flexibility and thoroughness. In order to permit subdivision of labor for simultaneous work upon several divisions of the books at one time,

subsidiary ledgers were adopted for main accounts of the general ledger to permit analysis in detached records of detailed transactions of like nature. In turn, the deleted subsidiary ledgers were replaced in the general ledger with one controlling account for each separate subsidiary ledger. Every posting made in each subsidiary ledger was reflected in summary entries made to the controlling account. In this way the heavy volume of work was decentralized and spread over adequate personnel. The Accounts Receivable account was supported by the Sales Register. The Accounts Payable account was regulated through the Voucher Register. The Materials and Supplies Inventory was governed by the Stores Ledger. The Work in Process Inventory was analyzed through the Cost Ledger. The Finished Goods Inventory was maintained through the Stock Ledger. Likewise, the Cash account was controlled through the Cash Receipts and Cash Disbursements Books. Payroll Accrued, Selling Expense, Administrative Expense and Factory Overhead are other examples of accounts commonly supported by subsidiary schedules. In fact, wherever an unwieldy volume of work is required to maintain an account in the general ledger, it is common practice now to employ a subsidiary ledger for analyzing the controlling account.

Along with improved structure in the basic foundation of accounting systems, management required more information about its business. Cost systems were installed to measure production values, more closely determine ultimate profit, and promote production efficiency. Departmental

analyses of expense were required to detect internal wastes. Systems of budgetary control were devised to measure performance against estimates. Statistical data of pertinent nature was demanded.

The development of large scale business extended competition on a wide and national scale. Operating margins became closer. Management desired more frequent financial statements and wished to have quicker and better facts at hand to regulate the favorable and unfavorable elements in their current problems. In order to earn a fair return, expenses needed to bear proper ratios to income and the urge was paramount to keep expenses at a low ebb. In all the intensive systematizing, management expected the best, the quickest, the most accurate, and the most economical results of its accounting organization for the money paid. Satisfactory results were not always obtained for various reasons among which the common are outstanding. Current closings were always late. The system was too costly. Management was not securing enough information about the business. The money spent was for the accounting system was all the company could afford, but yet the expenditure was not preventing losses or detecting wastes. The proper control was not being obtained. The system was too elaborate for the needs of the company and unnecessary peak loads were being carried. The procedure was often inflexible to change. The pressure of work required simplification of method in maintaining inadequate accounting structures when business was expanding and really demanded more complex accounting structure. Facts

were not being presented until long after they should have been, when it was too late to act upon the information by prevention of losses or by enlargement of profits.

1.3 The Use of Tabulating Machine Systems for Accounting and Statistical Purposes

Tabulating machines were developed in 1887 by Dr. Herman Hollerith, a distinguished statistician in the employ of the United States Government for use in the 10th Census.[1] He invented three machines to revolutionize the method of compiling of the decennial Census. A key punch was devised to transfer census facts into tabulating cards by means of punching holes.[2] A sorting machine was created to classify information into like classifications by mechanically distributing the cards to pockets in the machine.[3] A tabulator was perfected to count or add the cards by electrical operation singly or in groups as the case might require.[4] In 1889 a committee of three members employed by the Government to investigate methods of compiling the 10th Census reported that Dr. Hollerith's punch would transcribe data in three-fourths of the time required by any other known method and that the tabulator would add the final results in one-eighth of the time of any other plan. Dr. Hollerith's machines were adopted and the United States became what it has remained ever since, - the largest user of tabulating equipment in the world.[5]

The first commercial use of the extended machines arose in the New York Central Railroad Office for the audit of railroad freight accounts and the accumulation of commod-

1,2,3,4,5 International Business Machines (I.B.M.) Bulletin 1-Page 2

ity statistics.[6] The second important commercial field for punched card accounting was opened in adaptation to the actuarial work of insurance companies. The entire field of large scale business was prolific for use of tabulating machines.[7] Applications grew in number, size, and variety. The introduction of new devices and the improvement of existent equipment created new uses. The spread of tabulating machines for accounting and statistical use is today universal. Hardly a business of leading consequence may be found in the industrial field which does not make use of tabulating systems for one or more phases of accounting procedure.

1.4 The Problem of this Thesis

The aim of this study is to demonstrate the broad range of tabulating machine adaptation. The history of machine development will be briefly discussed. The importance of relative machine units will be described. One of the main objects of this report is to illustrate how decisively punched card systems have supplanted inadequate manual procedures. Emphasis will be given to the wide fields of opportunity which have followed the introduction of the newer devices of the past few years. The growth of the tabulating machine industry has been so phenomenal that it ranks almost without a peer in the degree of success achieved. The outstanding accomplishment of the tabulating machine industry, ever since its incipiency, has established a record which few businesses can parallel. In times of depression, when concerns in general were sustaining heavy losses, lowering dividend rates, or

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passing dividends altogether, the tabulating machine business enjoyed some of its best years. This was due largely to the greater requirement for curtailing operating expenses of business in the recession period, with resulting expansion in use of punched cards as a means of economy. The future of the tabulating machine industry will be considered at length.

1.5 The Treatment of the Problem

The case material for this study was determined by personal investigation of the writer at the primary source of the data, through conferences with business executives in customers' offices and interviews with salesmen of the tabulating machine manufacturers. Several illustrations will be selected in the industrial field, including the problems of sales and cost of sales analysis, accounts receivable, production control, payroll, and finished stock inventory regulation. Actual installations will be described in the public utility, railroad, ans insurance fields. Representative uses of tabulating machines by government will be discussed. Two of the industrial cases cited will be treated technically to convey a laboratory impression of the step by step performance involved under the tabulating method; the other cases will be studied thoroughly, stressing chiefly the flow of work and the results obtained from the machines with only casual reference to technical machine requirement for the work done. A general survey of certain common elements in the illustrations chosen will indicate the advantages of automatic tabulating accounting in comparison with slower, more laborious, and more costly manual method.

2.0 The Basic Concept of American Progress

2.1 General Developments in the Growth of American Industry

The United States of America for many decades has been indisputably recognized as the wealthiest, the most progressive, and the most highly civilized nation in the world. The keynote of the unparalleled success of this country has been the combined prevalence of abundant natural resources with initiative and means of developing these resources to their fullest. The American system has always been a capitalistic regime. Dating from our early pioneering, competition between individual entrepreneurs has been the steadying, regulatory influence as industries were born, first thriving in local communities and later dispersing throughout the land. As expansion took place corporate management replaced the form of individual ownership of business. The number of firms engaged in similar undertakings increased with the prosperity of the nation. Then came the machine age, fostered by a multiplicity of inventions, to hasten the growth of corporate control and the formation of our industrial giants through large scale production. As business grew, expansion took place vertically as individual concerns expanded their markets and absorbed their competitors and horizontally as they diversified their products by investment in other lines. The development culminated finally in the consolidation and merger movement, with inherent tendencies toward monopoly in the largest companies. Bolstering this tremendous growth through-

out were two paramount influences, the tone of which was the same in each instance. First, the existence of a strong and unified central government lent to industry a security and freedom for expansion which it did not possess in other countries torn by internal conflict. Second, the coalition of men, money, and machines, expressed in the one word "organization" permitted the consistently successful completion of colossal tasks.

2.2 The Representative Growth of the Tabulating Machine Industry

Following the successful introduction of tabulating machines by Dr. Hollerith in 1887, for use in the compilation of the 10th Census, the Tabulating Machine Company was formed. It was a successful enterprise from the beginning.[8] The early company and the tremendous concern of today possess one common characteristic, the difficulty of delivering machines when wanted because of voluminous unfilled orders always ahead.[9] In 1911, the Computing - Tabulating - Recording Company was formed as a holding company to take over the ownership of three non - competing firms. The Bundy Manufacturing Company was formed in 1889 to manufacture the card time recorder. The Dey dial time recorder was patented about the same time.[10] In 1891, The Computing Scale Company was organized in Dayton, Ohio.[11] The Tabulating Machine Company was organized under a New York charter in 1896.[12] All three companies flourished. At this time the possibilities of increased efficiency and improved control of business through merger were being

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explored. By 1907, the International Time Recording Company had acquired the properties of the Bundy and the Dey firms.[13] Curiously enough, each of the three companies entering into the merger was established at about the same time. It is equally noteworthy that the Tabulating Machine Company, at the outset the least formidable of the three units merged, quickly forged to the front as the most important division, far outstripping the others as the businesses grew. The name of the Computing-Tabulating-Recording Company was changed in 1924 to the International Business Machines Corporation, as the growth and extension of company activities had rendered the old name too limited for the scope of the organization. The 1924 company compared with the 1911 firm as a ten year old oak tree compares with its seedling. In physical size, - in number of employees, capacity of factories, number of branch offices, and territorial field of business - it had more than doubled.[14] Since 1924 the company has continued to double in size and activity every five years.

In similar fashion, the Powers Accounting Machine Corporation was merged into Remington Rand Business Service, along with the Remington Typewriter Company, Rand Kardex Company and Library Bureau.

3.0 The History of The Tabulating Machine Industry

3.1 The Early Stage of Manually Operated Machines

Tabulating machine systems were made possible by the invention of the three cardinal units of key punches, sorters, and tabulators. The early devices were manually operated, and little need be said to describe them. The speed of obtaining

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results was slow. In the absence of printing units synchronized with adding mechanisms totals had to be manually transcribed from visible counters. Tabulators were limited to accumulation chiefly of only one type of information in individual counters from individual adding fields. There was no means of securing a total for control groups of like identity except as the tabulator was cleared by hand.

3.2 The Intermediary Stage of Making Machines Automatic

The most important engineering problem ever solved in the history of tabulating was the development of the tabulator into a fully automatic unit. These difficulties will be better appreciated in a later phase of this study when tabulator specifications are discussed. For the moment, a tabulator is pictured as a multi-bank adding machine with independent adding mechanisms called "counters", in which totals may be obtained from the same or different card fields from one run of punched tabulating cards. One of the outstanding difficulties was to make the tabulator clear its counters automatically at the end of control groups. The clearing or "resetting" mechanism of a tabulator may be likened to the sequence of striking the space key and the total key to obtain a total by adding machine. The first tabulators were cleared manually at the end of each group. The next totalizing arrangement was to place manually a "total" control card at the end of each control group, which made the tabulator clear automatically but which also required the manual operation of filing the "total" card.

The problem was further simplified by sorting "total" cards pre-punched with the control designations behind the detail cards as the cards were classified for tabulating in the sorter. The totalizing problem was not solved electrically until 1921, under circumstances which were both fortunate and dramatic.[15]

During the World War, when all industries expanded so heavily, the tabulating machine business increased tremendously. In the post-war depression, however, when a subnormal rate of production resulted from large stocks accumulated in the war emergency and when the facilities of war time administration became modified to ordinary needs, so many tabulating machines were released from rental by government and industry that the stock of used equipment returned threatened to undermine the current production schedule. In other words, the large stock of finished goods was competing with the current work in process. The company was ready with the proper move and announced the automatic control, self-totalizing printing tabulator, in one act making the whole previous line of tabulators obsolete. The automatic control principle was not entirely perfected for two or three years later, but when finished was a job well done, for little change has been made since 1925 in this feature.

In the middle period of progress other important changes took place, such as the substitution of the 45 column tabulating card for the 34 column tabulating card in 1910.[16] All machines were electrified. Speeds of equipment were in-

15 Conference with E.Betz-I.B.M. Salesman
16 " " " " " "

creased. The electric plugboard permitted 100 per cent flexibility in adapting the machine to running a certain report form. The key punch was standardized as a twelve key machine. The principle of group indication, or first card elimination was perfected so that the indicating information which identified the control groups would not add, but only the first card would print, while the totals obtained from the adding fields might represent hundreds of cards. Other main features of extreme importance were introduced in the intermediary period, but these were only a harbinger of what was to follow.

3.3 The Specialized Period of Today

As the various engineering features of the basic equipment were perfected, each basic change made the machines more valuable to business. It naturally followed that as the usefulness of the machines increased by improvements in manufacture, the advantages of punched card systems were correspondingly magnified, especially from the viewpoints of lowered costs and saving of time. The progress was matched with similar increases in revenue through an avalanche of orders from new users. Following the mastery of the problems of the fundamental equipment, the research laboratory devoted especial attention to the development of further devices to perform automatically various functions that had arisen in connection with systems already established. The five year period from 1932 through 1937 is amazing from the viewpoint of the number of totally new devices introduced and the further improvements in former equipment. The tabulating machine indus-

try has instituted such important changes in the last few years as to minimize in obscurity the prior forty-three years' accomplishments all together. It must be emphasized at this point that the changes from 1932 on were major in significance, since each new product announced augmented the extended family of uses to which machines could be put. Service was now established on a basis of an absolute machine flexibility, and results were achieved which would have exceeded Dr. Hollerith's fondest dreams. The response from customers was instantaneous. It now became common practice for customers to divert several major types of accounting work to one expanded, versatile tabulating bureau. The tabulating machine industry benefited in several ways, through expanded requirements from present customers, through greater inducements to gain new customers because of more complete lines and greater experience, and through liberation of totally new uses in fields hitherto undeveloped. Machines were offered in such swift succession that tabulating machine salesmen were at a loss to be fully informed of their specifications. The line of equipment had been broadened so radically that it was a difficult sales problem to select the right machines for use in distinct fields. The most acute problem of all was the adequate maintenance of installed equipment. The engineering laboratory was months ahead of the sales force and years ahead of the field repair service. As a result, educational facilities were provided at the tabulating machine factories for training salesmen and maintenance men. It became necessary for the repair groups in the branch offices

to hold weekly meetings to keep abreast of installation data and maintenance for new equipment.

A few examples will demonstrate the intensiveness of this crucial period. Most concerns needed cumulative figures for certain reports and had avoided secondary runs of tabulating cards by manually punching summary cards from the report tabulated in the original run. The duplicating summary punch was an automatic machine, linked with the tabulator through a cable which produced a summary card for each item on the original report, simultaneously as the report was tabulated. This machine permitted automatic balance forwarding, eliminating manual operation previously necessary, and offered advantages in proving reports hitherto not realized.

The multiplying key punch permitted the multiplication of eight digits times eight digits at a speed several times faster than it was possible for expert manual operators to compute by electric calculator. The punching of each extension was simultaneously obtained in each tabulating card and the sum of the extensions for the machine run accumulated in a visible products counter for control purposes. Later, cross footing mechanism enabled the multiplier to compute and punch net results in the final extension field, achieved through automatic control of individual factors from several fields in the tabulating card. This machine was the direct stimulus to promoting tabulating installations for payroll and cost accounting.

A whole series of alphabetic accounting machines was announced a few years ago. This equipment permitted the tabu-

lation of letters as well as numbers and enabled the delivery of finished reports directly as they come from the machines, with no decoding, addressing or other change in form. The complete alphabet was obtainable by printing any of twenty-six different alphabetic characters from only twelve punching positions in the individual column of the tabulating card. The letters could be printed in normal reading sequence with no intervening spaces between letters, and no symbols were combination characters to signify more than one letter. Each of the alphabetic type bars could also be used as a numeric bar, including all digits from 0-9, and one extra position was available in each bar for printing a special symbol. In other words, by means of a zoning circuit, each type bar in the alphabetic section could optionally be used as an alphabetic unit or a numeric unit. This arrangement made the alphabetic tabulator completely flexible, automatically controlling the printing stroke for a letter or a number impression. The first alphabetic tabulaters were developed by Powers in 1925 but these machines permitted only a limited alphabet as only certain characters could be punched in a single column. This meant that assignment of letter positions to individual columns was devised with relation to their word frequencies. When names were printed from this early alphabetic tabulator the horizontal spacing of letters was at random, as certain card columns had to be selected with spaces intervening, to choose the letters desired. The punching sequence was inconvient in the first alphabetic machines.

The reproducing punch was introduced by International to provide a convenient flexible machine for several distinct purposes. The machine was equipped with two card feeds and two stackers for accumulating cards which had passed through the machine. The punched cards to be reproduced were placed in one feed and the blank cards to be punched in the other. When the machine was operated, the data was reproduced, from the punched cards into the blank ones. Complete flexibility was provided in the transfer, as a particular column in the setup card could be transferred to any of the columns of the reproduced card. The new machine was of tremendous value to insurance companies which frequently have the problem of transferring information from one card form into another. It was also a useful machine for replacing a worn card file with a new one. Another important use existed in transferring the punched data from a file printed from a previous electro-type into a new file based upon a revision of card form through the medium of a new electro-type. The machine was especially valuable as an automatically controlled gang punch. In former gang punches it had always been necessary to set a die plate manually to repeat punch any number of cards of like identity. When wishing to gang punch from a different master card, it had been necessary to change the die plate manually to secure a new control for the next set to be gang punched. This was an unsatisfactory operating condition, as much setup time was lost to operating efficiency since in the typical case only a few gang punched cards are needed for each different group.

The reproducing punch allowed the intermittent stacking of master setup cards with detail cards to be ganged, and when the cards were fed through the gang feed of the reproducer, the machine automatically cleared itself at the end of each group ganged and determined a different setup automatically from the new master card. This was accomplished by engineering a mechanism which was actuated from a control position punched only in the master cards. As the cards passed through the machine all cards gang punched would be identical until a new master card containing a control impulse was reached, at which point the first setup changed and a new one was automatically arranged.

These typical examples illustrate the variety of new and important developments. The high speed summary punch, the direct subtraction tabulator, the interpreter, the alphabetic printing punch, the bank-proof machine, the comparing reproducer, and the collator were other important devices during the recent period of greatest progressiveness, and these will be discussed in due course.

3.4 The Tabulating Machine Company

It has already been stated that the Tabulating Machine Company is by far the leading division of the International Business Machines Corporation. There are 73 main offices in the United States with many sub-offices. The company maintains other offices in all the principle cities of the world. It owns and operates eight factories in six different countries.[17] The main manufacturing plant is located at Endicott, New York.

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The world wide scope of the service geographically is matched by its functional scope. The ramifications of application in every field of commerce and industry could only be adequately described in several volumes, and it is striking that when printed, much of the information would be rendered out of date by to-morrow's inventions. This thesis, although sampling the fundamental applications of today, is at best but a fore-runner of the further advances yet to come. The company has recently purchased a 20 story office building, in New York City for housing its main executive offices. While for the time being this structure will be ample for the hugh administrative organization, the day will undoubtedly come when even these quarters will be outgrown. It should be observed parenthetically that while the domestic growth of the Tabulating Machine Company has been phenomenal, the foreign relations of the firm from the outset have been the most satisfactory of any American Corporation.[17a]

3.5 The Powers Accounting Machine Corporation

This company, a subsidiary of Remington Rand Business Service, is also represented all over the world. It is equipped with machines to perform most of the main functions available in the machines of the International Company. The two companies are the only concerns in the world which manufacture tabulating equipment. The main factory of the Powers organization is situated at Buffalo, New York.

3.6 The Rental Basis of Marketing Tabulating Equipment

Tabulating machines are not sold outright to customers

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but are leased, subject to self-renewing annual contracts which require the payment of monthly rental fees. This plan was born of necessity rather than choice. The intricacy of the equipment compelled precise and definite knowledge in the servicing of installed machines, and the task was delegated to throughly trained mechanics who were properly educated at the factory over a long period before being assigned to field maintenance work. New products and improvements came so swiftly that it would have been impossible for machine users to service the equipment properly. If the machine manufacturers had not recognized early the responsibility of providing suitable repair service, the lack of continuity in machine running hours would have hampered the development of satisfactory customer relations. As it is, machines have been maintained by adequately educated men, troubles have been promptly fixed, and the cost of the service and replacement parts is absorbed in the monthly fee established for the machines. The terrific obsolescence caused by rapidly changing technique would have deterred progress if customers had owned the equipment.

Since the machine companies at all times have title to their property on customers' premises, the customers are free to replace their old and depreciated equipment with new machines with the latest advantages. This aims for uninterrupted engineering progress except for the production delays caused by the tremendous flow of orders that follows announcement of machine changes. The machine companies salvage some of the parts after return of replaced equipment. When cus-

tomers change equipment to secure the advantages of totally new features, they also obtain the benefit of improvements made in the old features.

4.0 The Nature of the Tabulating Card

4.1 Specifications of the Tabulating Card

The importance of the tabulating card in a successful tabulating installation can not be overemphasized. The card is the medium by which the punch, the sorter, and the tabulator all perform their functions. Care in the manufacture of tabulating cards, which has remained an important responsibility of the machine companies, must be governed by the same standards of precision as those which characterize every step in the manufacture, assembly, and inspection of the machines themselves. Tabulating cards are manufactured from especially high grade paper stock. Not only must the card forms that are cut to measurement and run through the presses be uniform in size but also the paper must be strong in weaving quality and free from carbon, slime, froth spots, and other foreign particles that might act as conductors of electricity.[18] Careful experimentation has resulted in the establishment of standard tests to insure the uniform quality of tabulating card paper stock. Tabulating cards are printed on paper cut to a single width of 3¼ inches, and on one of two lengths, the short card of 5 5/8 inches, and the long card of 7 3/8 inches. Apart from the physical characteristics, tabulating cards are typified by their variations in column capacity.

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International types are built with capacity for handling cards of 34, 45 or 80 columns. Powers machines are manufactured to handle 45 or 90 column cards. The long form of card is almost universally used, and the trend of industry toward storing maximum information in the 7 3/8 inches by 3 1/4 inches form has resulted in a strong predominant trend toward manufacturing only machines for using the 80 or 90 column cards. The International Company secures 80 columns in the card by decreasing the horizontal spacing between column centers from 5/32 of an inch to 3/32 of an inch. The Powers Company obtains 90 column cards by dividing the card in the middle horizontally, so that the card is separated into two sections of 45 columns each; use of the lower section is distinguished from use of the upper section by the automatic perforation of a control position when the 90 column card is being punched.[19]

Regardless, however, of the number of columns on which a particular installation is based, the perforation of holes in the individual card column is guided by the same machine limitation. There are 12 punching positions in each card column, one for each of the 10 digits position, an 11th position used for control, which is commonly called the "x" position, and a 12th position. In numeric tabulators, the figures which actually print from the punched holes are the digits from 0 to 9, although the adding field may be a debit or a credit, a plus total or a minus total, according to regulation by the "x" or control position. In alphabetic

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equipment, the punching of the 12th, 11th, and the zero positions, respectively, in combination with the digits from 1 through 9, identifies the 26 letters of the alphabet by the automatic punching of two holes in the card column from the alphabetic key punch.

4.2 The Characteristics of Punched Holes

The 45 column punches of the International Company and all punches of the Powers Company perforate round holes 1/8 of an inch in diameter when the punching keys are depressed. The 80 column machines of the International Company punch rectangular perforations that are 1/8 of an inch long and 3/64 of an inch wide when keys are engaged. Both types of perforation are satisfactory for machine operation. As will be later explained, a fundamental difference in tabulating principle between the two makes of equipment governs the difference in perforation necessary. Exhibits 1,2, and 2A show examples of punched 80 column, 45 column and 90 column tabulating cards.

4.3 The Effect of Atmospheric Conditions upon Cards

Tabulating cards should be stored in cool, dry places for best results. Heat and dampness cause swelling of the edges, making passage through the machines difficult because of card jams. The cards are apt to curl or buckle if atmospheric conditions are unfavorable. Jammed cards are easily removed from machines, but if it becomes necessary to tear a card in order to clear the jam, the pieces may be fitted together and a duplicate card may be punched to replace the

Exhibit 1 — Hollerith 80 Column Card

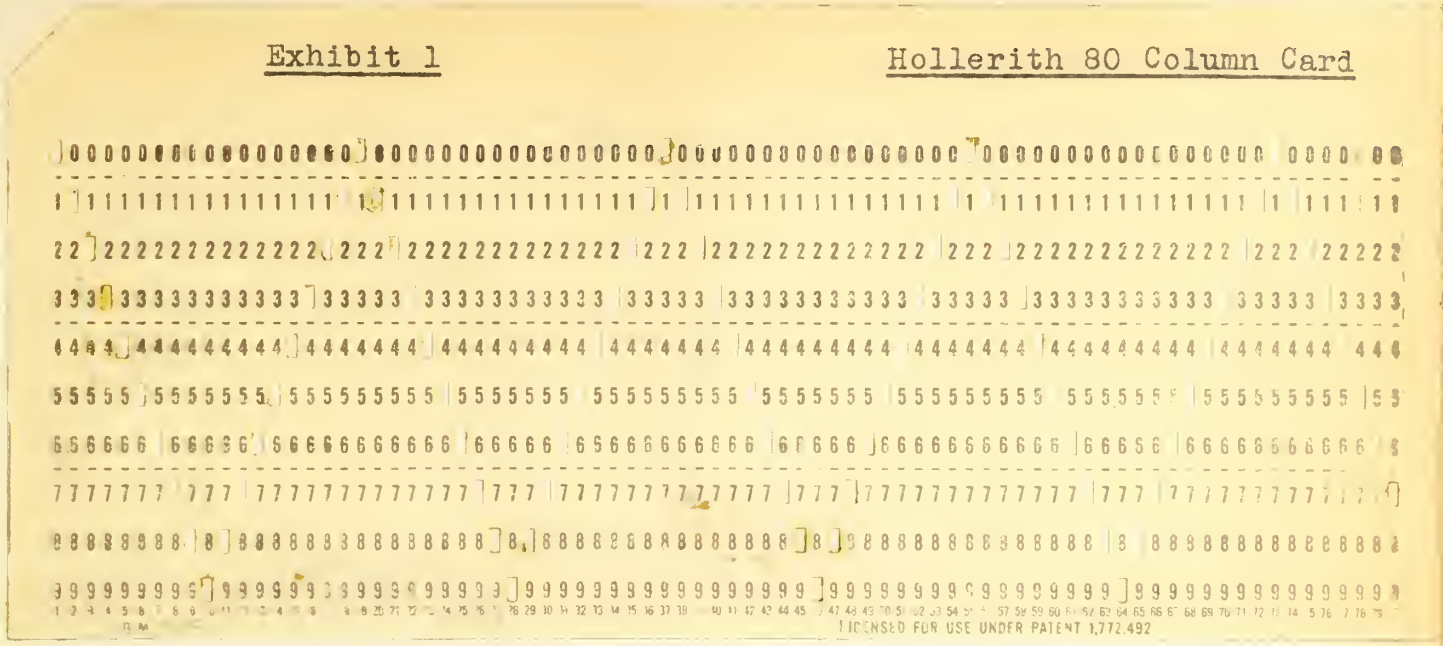


Exhibit 2 — Powers 45 Column Card

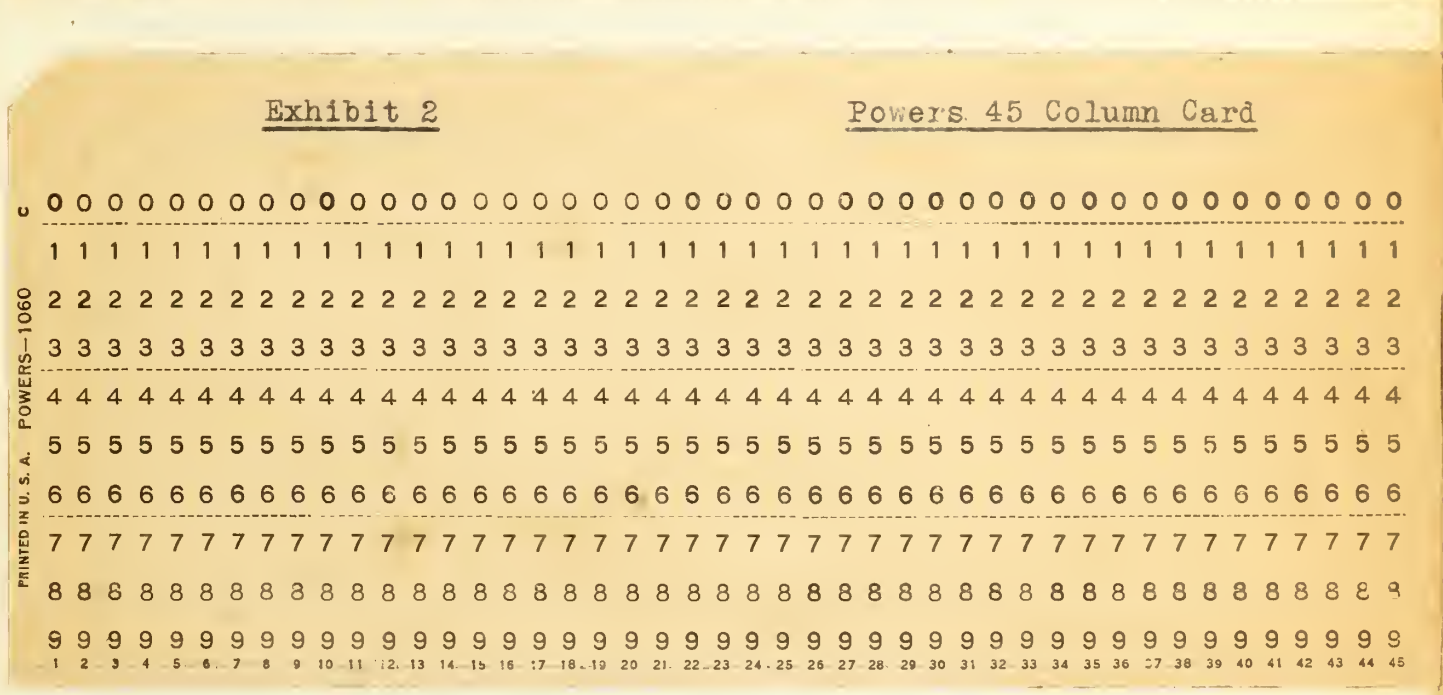
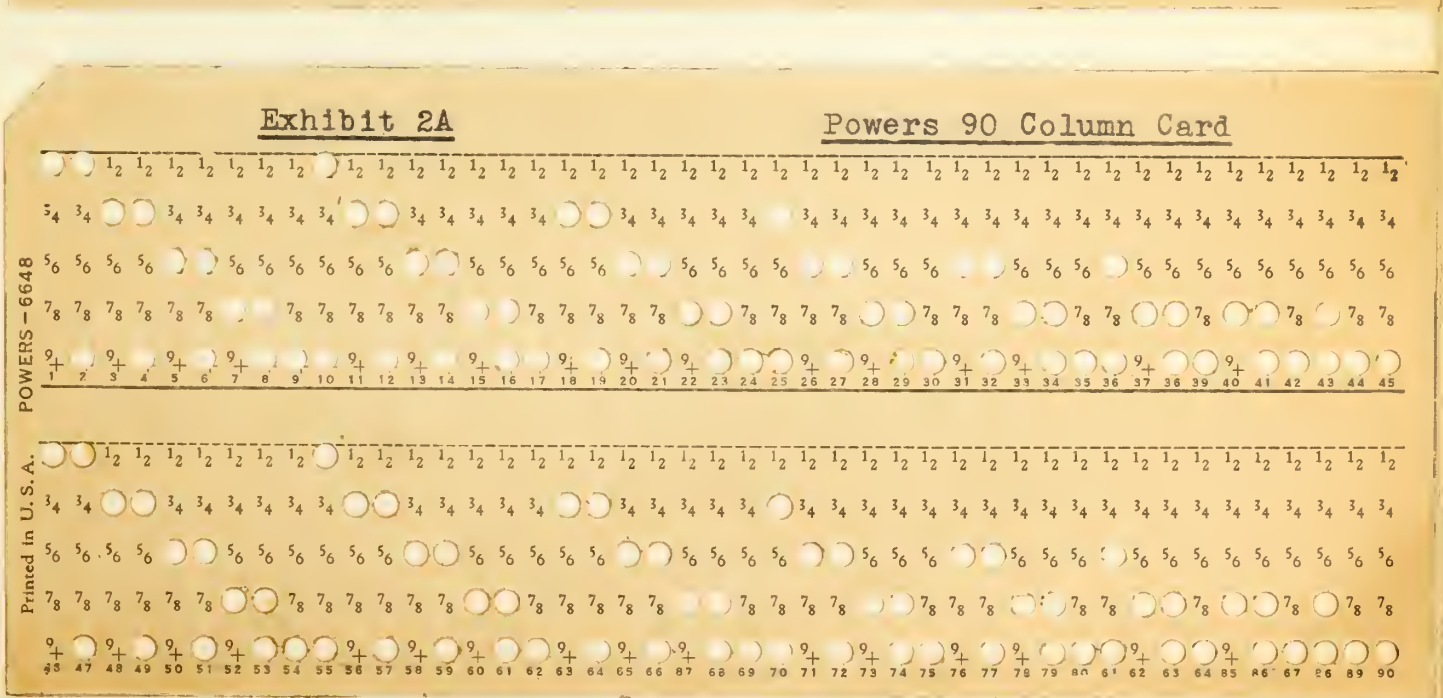


Exhibit 2A — Powers 90 Column Card



damaged one by reading the holes. It is only in the cases of extremes in temperature and humidity that the swelling of cards is in any sense an operating difficulty and on these occasional days the handicap may be offset by running only a few cards through machines at one time.

4.4 Passage of Cards through Machines

Nearly all tabulating machines are designed so that cards may be mechanically fed into the machine. In some machines the feeding stroke is a vertical one, in which instances stacks of about 700 cards may be fed at one time, but the machine must sometimes be stopped to replenish the card magazine. The trend in card feeding, however, is toward a lateral stroke, making use of the force of gravity to align the card even with the feeding knives and permitting continuous feeding of the machines while they are operating. The clearance of the card knives, which engage the card at the outside edge when the card is about to enter the machine, is barely enough to contact one card so that the machine will not be jammed by the feeding of two cards. In corresponding fashion the throat through which the card enters the machine is wide enough to admit one card, but not two. During the sorting process in which over 400 cards pass through the machine in one minute, cards in the same pockets have a strong tendency to stick together due to friction. This "static" is overcome by stacking the cards flush against the sorting frame, fanning the ends of a group with

one hand while holding the other ends firmly to admit air . The loosened cards will easily fall into proper position with absolutely flush edges. In view of avoidable operating inconvenience, tabulating cards should not be removed from the original container until about to be used. Current proven cards and the tabulating cards for prior months should be packed tightly in transfer trays by the use of locked follower blocks. The life of tabulating cards is determined chiefly by the quality of stock used and strictness of adherence to specifications. Cards made from short uneven fibers will not stand-up. From the outlook of use, some types of tabulating cards, like coding cards, are subject to many times the repeated machine use of others. Generally speaking, the practical life of a tabulating card used repeatedly in machines is seldom limited by any physical wear and tear upon the card, for various changes in content or form arise which demand a replacement of the card before it wears out. Cards which are used several times a month will easily last ten years if properly handled and filed.

4.5 Tabulating Card Terminology

Especial attention should be devoted to observing the different classifications of tabulating cards according to their use or origin. A detail or transcript card is the original punched card which is perforated from information previously recorded on some other basic record. This type of card is obviously the most comprehensive group since it provides the fundamental information in unit form which is later

classified, expanded, summarized, or otherwise affected by other cards.

A dual detail card is often the punched medium of a comprehensive machine job. A dual tabulating card serves the combined purposes of providing spaces on the face of the card for writing original information and card fields for transcribing this information by punched holes. The dual arrangement increases punch production effectively, since it eliminates subsequent reference to a source record and makes the card more readable.

Prepunched cards are cards which are wholly or partially punched with data in advance of their use as detail transaction cards.

Customer code cards are a combination of dual and prepunched cards which have a special and frequent use for automatically coding data used for classification in sales distribution. Prepunched cards and customer code cards are filed in trays and tubs behind identifying guide cards and are pulled in sequence of source material. Their important use lies in saving time and cost, enhancing accuracy and simplifying punching. Manual coding of the prepunched fields is eliminated, and the need for punching and checking of the coded field is almost entirely removed.

Any card designed for securing its perforations from totals secured from tabulations of other cards is called a summary card. Summary cards are usually obtained from a summary card punch linked to the tabulator through a cable.

Just before each control cycle clears in the tabulator and prints on the report form, a summary card, identical in punching with desired information in the tabulation, is automatically obtained. The major uses of summary cards are for balance forwarding and securing final consolidated reports.

Interpreted cards are tabulating cards which have been passed through an interpreting punch for recording in printed form above each punched column along the top margin of the card the numeric or alphabetic symbol which the punched hole represents.

Master cards or set-up cards are cards sorted ahead of detail cards and usually punched in a control position which operate to affect completion of a detail card for some factor which the master card controls. A payroll is extended in the multiplying punch by sorting master rate cards for each worker ahead of his individual time cards, or overhead is applied by sorting predetermined overhead master rate cards by department by operation number ahead of the labor cards respectively.

Any card designed for insertion with active cards for the purpose of producing a special type of report is termed an indicating card. An indicating card might be used in an accounts receivable installation to show ahead of each customer listed on the aged trial balance the credit ratings, the credit limit and the class of trade.

A name card is an alphabetically punched card also punched with numeric coding common to detail cards, which

when sorted ahead of detail cards will alphabetically decode the name of the items coded as the report is tabulated.

An address card is one usually used in connection with a name card to decode statements or other mailings as a report is tabulated.

An index tab card is a card having a visible lip which is used in tabulating card files for physically identifying cards of its classification which are filed behind it. Index cards are available which may pass through sorters and tabulators with the detail cards without changing the original filing sequence.

Tip-over cards are specimens which because of limited number of card fields in horizontal spread may be used twice by reversing the face of the card when punching the second time. A corner cut in the upper left margin might indicate the first position and a square left corner when the card was reversed would show the second position. This plan is obviously a means of reducing tabulating card cost where only limited information is required from the machines.

Whereas there are other terms for tabulating cards designed for special uses, the foregoing illustrations represent all the types of tabulating cards which may be considered general.

5.0 The Design of Tabulating Card Forms

5.1 Determination of Card Data

Of all the factors influencing card design the most

important are the requirements of the finished reports to be prepared. All information necessary must not only be included in the card but must also be arranged in proper form to facilitate all procedure. The factors next in importance are determined by the sources of the original information. These must be carefully studied to ascertain whether all data to be punched is available from the original documents. If not, the card data list may be revised or changes may be made in the source records so that the needed information is at hand. Often a dual tabulating card may be devised to replace the original record, also serving as the punching medium for perforating the complete data.[20] Once the list of data has been compiled, it may be divided into three groups as follows:

Reference Date - Data, Order Number, etc.
Controlling Data - Account Number, Salesman, etc.
Adding Data - Quantity, Sales Amount, Cost.

Such grouping of the card data aids later location of these items in the tabulating card.

5.2 Correlation of Number of Card Columns with Size of Fields

Any group of card columns representing a unit factor, like commodity number, is termed a "field". The tabulating card form must be planned so that there will be sufficient column capacity in each indicating, controlling, and adding field to provide for the maximum number of digits which will ordinarily be needed. Four digits might suffice for the account number. If five digits were enough for the money colums, except for an unusual case, then to save a column of two for expansion capacity, probably five column fields would be large

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enough. If there were an infrequent amount like $2862.37, then the punching of three cards for $900.00 each and one card for $162.37 would complete recording of the transaction in the five column field. When planning any tabulating card form it is advisable to provide a few unused columns in the electro-type to allow for expansion or change.

5.3 Important Rules Controlling Good Card Form design

The company name should appear on all card forms. All card fields should be properly labelled at the most advantageous point, either at the head, middle, or bottom of the detail card, unless the card also serves as a dual card.[21] All single column fields should have decoded abbreviations above each punching position.[22] All card captions should be as explicit in meaning as possible. The most important regulation of all for detail card design is the location of punching fields so that punching sequence follows the same sequence as data being transcribed from the original document; this mutual arrangement promotes peak efficiency in card punching and speeds up the entire tabulating procedure. Every detail card should contain a field for reference punching which will positively identify the card with the original record from which the card was prepared. Inasmuch as all corners of tabulating cards are square, customers may order their cards to be corner cut diagonally in a specified corner, which ensures, from the uniform location of cut corners of all stacked cards being sorted or tabulated, that all cards are right side up; the usual corner cut is 1/4 of an inch, and any card with

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an offset cut corner must be manually restored to proper position. Wherever five or more columns appear in a single field dotted lines should be drawn to mark off the decimal point.[23] It is absolutely necessary that punched information to be used for automatic control should be placed in exactly the same column positions in all different card forms jointly tabulated.[24] Twenty columns is enough capacity for punching of most names.[25] Alignment of summary card adding fields with detail card adding fields simplifies report proving and machine wiring.

5.4 Requirements for Good Dual Card Design

Dual cards incorporate all the principles involved in construction of detail cards, with additional distinctive features embodied in their use. The design of dual cards is especially important because they serve as original records in departments other than the tabulating department. They might be used as requisitions, labor tickets, and other shop records. A dual card as an original record must satisfy all accounting purposes. Generally, the written information should be placed at the left end of the card to obtain visibility of data transcribed during the punching operation.[26] Punched fields on an 80 column card should be at least 14 columns to the right of the written data.[27] Dual cards should not ordinarily be multiple-use cards. Horizontal lines should be drawn through the mid-points of the regularly printed digits. This forces writing into a position where it will not be obliterated by punching. Retain in the dual section

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as many of the punching digits as possible, to facilitate reading of the punched holes as necessary.[28] Any written descriptive information may be entered in the part reserved for the punched section, and although parts of it may be obliterated by punching, it can easily be reconstructed. Wide spaces should be provided for the especially significant writing at the left, as it should be borne in mind that workers in the shops are not as well educated as office employees and are apt to write in large characters with short blunt pencils.

5.5 Influences of Machine Construction on Card Design

Fields that are to be skipped in punching should be arranged to accomplish the work with a minimum number of skip bars. When cards are inserted in key punches equipped with automatic feeding devices, no card columns are visible in most machines. Fields punched from master code cards in the duplicator must be matched with the detail cards, column for column. Manually punched fields should not be inserted, where avoidable, between duplicated, gang punched, or summary punched fields. The 11th and 12th punching positions can be utilized for recording reference data but can never be tabulated.[29] Adding fields should not contain more columns than the direct adding capacity of the counter, which is usually eight columns. Control fields must never be left blank, and should be punched either with a significant figure or a zero. The 11th or "x" position governing direct substraction or class selection should never be placed over fields used for automatic control or alphabetic printing.[30] Data to be listed or added must be

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confined to positions from o to 9.

5.6 The Use of Color to Differentiate Cards

It is always desirable in a system to utilize distinctive colors to identify all cards printed from the same electro but used for different purposes. Tabulating cards are available in most suitable color combinations. The basic colors are manila and ivory. The color distinction may be easily achieved by the printing of a half inch color stripe across the top of a manila card. Thus a manila card might serve as a debit detail card, a red striped manila card as a credit detail card, a green striped manila card as a summary card, and a violet striped manila card as a previous year card. The color assists machine room employees in various types of work. Tabulating cards are available in all solid colors, and in certain combinations of solid colors printed with stripes.

6.0 The Preparation and Use of Codes

6.1 Serial Number Coding

The simplest form of coding is the assignment of consecutive numbers to items without provision for any group classification. At best its use is confined to not more than twenty or thirty items, or for longer lists in which it is positively assured that no classification will ever be needed. Its practical use requires either memorization or decoding, both of which are limitations to its value where it stands alone. The sequence code is a vital part of other coding

systems, however, where it shares a definite relationship in connection with some other group classification.

6.2 Block Coding

This type of coding is an expansion of serial number coding wherein groups of numbers in sequence represent certain classifications. A concern might manufacture 200 different classes of products. The different units within each class would be consecutively numbered. Any desired number of items may be included in each block. Thus an electrical supply house might assign digits 1 through 30 to electric irons, 50 through 100 to lamps, 130 through 150 to vacuum cleaners, etc. Each separate item is serially numbered in each class. Expansion is provided in a limited manner by reserving vacant spaces for additions.

6.3 Group Classification Codes

Group codes in which major and minor classifications are represented by the succeeding digits of numbers are by far the most efficient for the ordinary purpose. The following example is illustrative of group coding:[31]

1000 - Brass Materials		1020 - Steel Materials
1001	Strips	1021 Plates
1002	Sheets	1022 Castings
1003	Tubing	1023 Bars
1004	Castings	1024 Wire

The major class, 1000, represents materials. Numbers from 1001 to 1019 represent brass materials of specific kinds, and similarly numbers from 1020 to 1029 indicate different steel materials.

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In another case it may be desirable to codify 15,000 customers so that all accounts may be sorted into perfect alphabetical order by sorting progressive numerical columns, at the same time providing indefinite capacity for expansion. The alphabet could be broken into minute divisions each of which would be signified by a three digit code from 001 through 999. Division 545 might be Law; 546, Lawt; 547, Le. Code numbers would be properly assigned to customers by adding two digits to the three digit group code which would be selected on the basis of the first four letters of the customer's last name. This would provide a five digit code, with 100 code numbers for customers with identical or nearly identical last names. If a name frequency were taken of each group class, and the original code numbers for customers were assigned on the block principle, evenly spaced apart, then a perfect alphabetic sequence would be established by the complete numeric code. As new customers were added, half the distance between the two digit block range in which the true alphabetic position of the last name would fall would establish the new customer code number. There would still be capacity for expanding between the modified block ranges determined by the new number.

6.4 Letter Type Codes

This term has been applied to codes requiring use of abbreviated special type in the bars of numeric tabulators to accomplish limited results in printing alphabetic characters.[32] The following arrangement indicates the use:

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Name	Code Number	Printed Result
Pounds	36	LB
Ounces	69	OZ
Grams	27	GM
Grains	28	GN
Pints	74	PT
Quarts	84	QT
Litres	34	LT

6.5 The Automatic Coding of The Alphabetic Key Punch

It has been previously indicated that it is possible to print any of 37 characters from one type bar of an alphabetic tabulator, representing any of 10 digits any of 26 letters and one special symbol. Numeric or alphabetic characters are made possible by single punching or by double punching in the individual card column. The alphabetic punch has a standard typewriter keyboard. Depression of a numeric character above will cause the tabulator to print a digit from that column. Depression of a letter key punches the perforate of a 12th, 11th, or a 0 position in combination with one other digit. The internal wiring in the punch causes the automatic coding by the controlled perforations in the card column. Thus, a company utilizing involved identification of its products by lengthy descriptions intermittently arranged in numbers and letters could secure perfect registration of the exact specification by use of the alphabetic punch; if the code number were especially long, this company would probably adopt a subsidiary numerical classification code, also punched in the card, to facilitate machine sorting.

6.6 Decoding of Numeric Reports

When using alphabetic equipment, since any letter

of the complete alphabet may be printed from a single card column, the exact reproduction of the original name is obtained in a final tabulated report. Where numeric machines are employed, it is usually necessary to adopt numeric codes for letters, fractions, and their combinations with numbers. An annual report of customer sales for a particular salesman would print coded indications for salesman, customer, town, state, and line number or class of commodity sold. Before the report is released from the tabulating department, the coded sections are decoded by reference to a source record. It is common practice to decode the final tabulation in a typewriter, where duplicate copies are required, accepting the form in which the report provides the information as final. It is not often necessary to decode account numbers for book purposes, as the ledger accounts may easily be set up in code, and the decoding is automatically achieved when posting by account number. It is always the duty of a tabulating section to release work in final readable form so that the individual who receives the report will have no uncertainty as to identity of the information.

7.0 The Importance of Control

7.1 The Principle of Controlling Accounts

In order to eliminate numerous entries from general ledger, subsidiary books of account are maintained for the posting and accumulation of all detailed transactions of each subsidiary class. One controlling account is maintained in the general ledger for each subsidiary ledger, and postings to the

controlling account are made from summary entries obtained by footing the subsidiary ledger. The net balance of the controlling account agrees with the sum of the net balances of all individual items in the subsidiary ledger. The Work in Process Inventory account in the general ledger is supported by the Cost Ledger in a production order cost system. A cost sheet is made up for each production order issued and accumulates all the costs which are incurred. The entry for accumulating total manufacturing charges on cost sheets is as follows:

Work in Process Inventory, Dr.

Materials and Supplies Inventory Cr.
Payroll Accrued, Cr.
Factory Overhead Applied, Cr.

Factory overhead is applied to finished jobs as they are completed, and to unfinished jobs at the end of the month. Completed orders are costed in total as they are finished, removed from the Work in Process file, and posted respectively to inventory cards in the Finished Stock Ledger, according to the entry,

Finished Goods Inventory, Dr.

Work in Process Inventory, Cr.

The total accumulated cost of unfinished cost sheets at the end of the month represents the balance in the Work in Process Inventory account.

Sub-controls may be established which resemble in principle the controlling accounts of which they are sub-classifications. The method of sub-division facilitates the location

of errors. When detail ledgers are checked, all groups which balance to the sub-controls need not be analyzed. The repetition of detail work for checking is thereby limited to the sub-groups which do not balance. For convenience, control sheets are devised which allow daily posting of amounts affecting each sub-classification. Wherever discrepancy occurs between the balances in the detail records and the control, the causes of variance might be the following:

1. Totals or new balances were incorrectly figured.
2. Debit or credit postings might have been entered on the wrong side of the account.
3. A subsidiary ledger posting may have been omitted or duplicated.

7.2 Use of Control Sheets in Tabulating Systems

The maintenance of controls in accounting procedure serves the two-fold purpose of proving that work is correct by the balancing of distribution accounts against controlling accounts or that the work fails to balance. The main function of control procedure, aside from the balancing of correct work, is to localize errors so that they may be easily detected. In a well planned tabulating installation a double check will be devised for every step of manual or machine procedure. Inasmuch as adequate control enables a supporting basis for every step of the work up to proving the trial balance and preparing final distributions, there is no difficulty in matching any information obtained from the tabulating card against the source material. The tabulating department must use a control sheet which is divided into sub-classifications, like branch offices or ledgers for daily posting of totals obtained by tabulating

the punched holes. These totals are checked to agree with predetermined footings taken from the adding machines tapes which are frequently attached to the source material as it arrives in the tabulating department. In an illustrative case, the accounts receivable department and the tabulating department each receive copies of customer billing independently. The two sets of invoices are added separately in each section and checked daily to ensure that each section has received the same bills and that the control footings agree. The proven predetermined amounts are entered on a preliminary tabulating control chart, which segregates gross and credit sales amounts, by billing offices by branch offices, on a daily basis. The punched cards for each sub-division are proven by tabulator addition, and the machine totals, when checked with predetermined control and found to be correct, are posted to the tabulating department final control sheet. In this particular instance, the tabulating department proves its sales control with a predetermined sales control in check with accounts receivable, but by an internal double check it establishes its own control over quantity and cost of sales. The results obtained from any tabulating job are no better than the degree of control exercised over the work. It is much easier to lay out a system that will be self-balancing, with an orderly sequence of positive checks, than to operate on a carelessly conceived plan in which control break-downs are too broad for satisfactory results or in which no check is maintained over some factors.

7.3 Methods of Verification

There are various efficient methods of proving punched

tabulating cards, each of which is the most suitable under specific conditions. One common procedure is to use a verifying punch for the work, and while this method is a positive proof of every punched hole in the tabulating card that was punched originally, it entails the cost of the verifying equipment and the repeat punching of all the work to detect a small percentage of error. Wherever possible it is more advantageous to use prepunched or duplicated fields in the detail card for indicating or control information, and tabulation of the punched holes for all adding fields, to check with predetermined totals. Certain common holes in card groups may be sighted or needled to ensure that the cards are correct. Since the use of prepunched codes in the detail card, controlled by a carefully checked master setup card, offers, in addition to accuracy, the simplification of coding and elimination of manual punching of the coded fields, there is much in favor of the prepunched card plan. A common method of proving adding values when the control group is extensive, such as 2500 cards, is to divide the large group into about 25 packs of 100 cards each, to prove the tabulated punched hole totals of each group with control totals footed by calculator from the original records. Another satisfactory procedure for control checking is to punch machine summary cards simultaneously with the tabulation of detail cards. The summary cards are run for total to prove with predetermined control, and if correct, the detail cards are right. The summary cards might then be used in an open tabulating file, or use to reproduce a duplicate set, and the original cards

could be used for distribution. Whichever control method is used, there should be good reasons for justifying its particular choice.

8.0 Key Punches

8.1 Function and Description

The basic principle underlying the operation of all tabulating machines is the completion of an electrical circuit or mechanical engagement through punched holes in tabulating cards. The key punching machine is the medium by which detail is transcribed from a manual record into a tabulating card by means of perforated holes. The punching operation is the simplest and the most routine of all the machine functions, yet it is one of the most vital factors of determining the degree of success of the tabulating method. Much of the tabulating card punching is a manual operation by means of key depression, whereas most other types of tabulating apparatus are automatic in operation. It takes but a short time to produce final tabulations once cards are completely punched and verified. The punching operation corresponds to the posting operation of a manual method. It provides the important advantage that once the punched card is proven, it becomes a permanent record from which accumulations and subsequent distributions may be taken with positive accuracy with no problems of transposition of digits, erroneous classifications, duplicate entries, or errors of omission which are embodied in manual summarization. In the typical case, a leading measure of the effectiveness of

the tabulating method may be judged by the cost of producing the proven tabulating card. All machines subsequently used possess such outstanding advantages in their speedy, accurate, and automatic performance that manual operation cannot compare favorably. This automatic machine accomplishment generally justifies all overall cost of the entire application, and produces superior results with attendant savings that earn permanent recognition for the punched card method in comparison with any other plan.

The punch developed by Dr. Hollerith, called the pantograph, contained a holder in which the inserted tabulating card was stationary. The punching was accomplished by a sliding rack which could be shifted to any predetermined location to punch a hole in any column. This device was slow and was replaced by a key driven machine. The standard numeric keyboard has keys for punching 12 different positions in any tabulating card column.

8.2 <u>The Hollerith Manual Punch</u>

This mechanical key punch, designed for punching a 45 column card with round perforations, was developed as a simple, compact, and effective unit of rugged design. It has 12 punching keys in three staggered banks, inasmuch as ideal operating results are attained when punch clerks use three fingers. All punch keys are equipped with rubber tips. The 0 to 9 positions are similarly marked, the 11th position is labeled "X", and the 12th position is blank. The keyboard contains two other keys, one for spacing one column at a time

and the other for ejecting the card from any card column. Each individual card is placed in the card bed at the left of the machine, and is inserted underneath the punch keys by movement of a carriage operated by a thumb lever at the extreme left. When a key is depressed, punching a hole, the carriage automatically advances one space. The punch is provided with a means of skipping certain columns similar to the tabular device of a typewriter. Pushing of the "X" key, in conjunction with a special skip bar, causes the carriage to skip several columns at once and to stop at some predetermined point.

8.3 The International Electric Numeric Punch

Since Dr. Hollerith was instrumental in developing only the earliest machines, products of the Tabulating Machine Company will henceforth be referred to under the present day name of "International", The International 80 column electric numeric punch has a keyboard similar to the mechanical punch. In the electric punch the holes are perforated by the action of an electro-magnet, whereas in the mechanical punch the holes are cut by manual pressure.[33] Since less effort is required to depress the keys in the electric punch, the fatigue element is much reduced and the punch operator can produce at least 25 per cent more work. A good numeric key punch operator, manually feeding and removing all cards, will punch about 2500 cards or more per day, depending upon the number of manually punched columns in the 80 column capacity. Nearly all tabulating machine customers have increased their machine capacity by installation of 80 or 90 column equipment in the last few

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years.[34] The change has not only enabled customers to secure more information from the individual punched card but has also facilitated machine punching since more facts can be recorded with less handling of source material.

8.4 The Motor Drive International 80 Column Punch

The improvements afforded by this important machine were the addition of an automatic feed for inserting the cards and the incorporation of an ejecting device to remove the completely punched cards from the machine.[34a] Inasmuch as the feeding and the emission of cards was made fully automatic by these changes, punch operators were enabled to keep their right hands always free for punching at the keyboard and their left hands free for moving source material. The advent of the motor drive punch considerably increased the efficiency of operators in those cases where it could be applied.

8.5 The International Duplicating Key Punch

This particular kind of punch has been widely utilized because of its duplicating feature. The object of the duplicating mechanism is to control by the use of a prepunched master coding card the reproduction of its punched fields into the same fields of detail cards. A duplicating rack is located directly above the detail card bed at the left of the keyboard. A master code card is placed in the duplicating rack and a detail card is fed into the card bed. The duplicating door is closed and both cards are fed into the duplicating punch by the thumb lever. The operator punches the manual section of the card in the ordinary manner, but when the ejecting cards reach

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the duplicated fields, the master card automatically reproduces into the detail card in corresponding fields. If there are 50 detail cards used for punching from the same original record, the same master code card may be employed for duplicating the common fields in the detail cards. For example, if the original document was a customer's invoice containing 50 items, the common information of customer number, class of trade, town number, state number, and salesman number would be duplicated in all detail cards from the master code card. The purpose of the duplicating punch is to eliminate coding, manual punching, and checking of the duplicated fields. To arrange work for punching in this machine, master code cards and detail cards are pulled from source records and interspersed between sheets. The entire operation saves much time and the results are accurate.

8.6 <u>The Powers 45 Column Numeric Punch</u>

The Powers numeric punch has 12 key punching positions like the International, but the actual punching operation differs in one important respect. In the International machines, a punching key cuts as soon as the key is depressed. In the Powers punches, depression of the keys sets up a die plate with each key depressed until the entire card is traversed, when all holes are punched at once by striking a trip key.[35] This feature is especially desirable in a key punch, for whenever the operator knows she had made a mistake in a column she may correct the error before punching the card. This factor results in time saving and decreases card spoilage.

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In International punches a card is destroyed whenever the operator presses the wrong key, which discards the correct work in the card up to the point where the error occurred. The Powers punch has an automatic feed box in front of the die plate. The ejection of the punched card is automatic with depression of the trip key and the cards pass to a stacker at the rear of the machine. The Powers punch possesses the outstanding advantage of optional use as a gang punch, because of the die plate setup action which causes all holes to punch at the same time.[36] By means of an adjustment, the setup is prevented from clearing with each card cycle, and therefore any number of cards may be repeat punched, or gang punched, with the same information at a speed of 100 cards per minute. It is possible to gang punch part of a card while manually punching others. Any column may be double punched by depression of two keys at once when making the setup. By addition of an attachment, the cards may be consecutively numbered as they are gang punched.[37] The range of the numbering covers eight dials of which four are designed for serial numbering and four are arranged for identifying the fixed group numbers. The machine may be used as an alphabetic punch by using special key tops which contain letters as well as numbers, and by single and combination punching, the alphabet may be registered in a single column. Skips are obtained in the Powers punch by striking a skip key which causes the machine to jump the positions marked off by variable skip stops.

8.7 <u>The Powers 90 Column Punch</u>

To obtain 90 column capacity, the Powers Company di-

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vides the standard size tabulating card by a horizontal line through the middle into two sections of 45 columns each. The complete registration of punched holes for the ten digits is accomplished by single or double punching in the six vertical punching positions of each section, according to the following table:

Position No.	Single Punching	Double Punching With 6th Position
1st	0	
2nd	1	2
3rd	3	4
4th	5	6
5th	7	8
6th	9	

The 90 column Powers punch has three sets of keyboards. The first keyboard permits punching of 45 column cards with single holes for all digits, and the second and third keyboards perforate, respectively, the upper and lower 45 column sections of the 90 column card with automatic double punching of the even digits.[38] This flexible punch permits combination card form design, so that a part of the card may be on a standard 45 column basis and part on the 90 column basis. Powers tabulators are wired in such a manner that the machines will accumulate from the single impulse of a 45 column card position or the single and double impulses of 90 column card positions with only one run of cards. The 90 column punch possesses all the other advantages of the 45 column punch, is fully automatic in most respects, and may be used as an alphabetic punch by covering the first keyboard with combination key tops.[39] Both Powers automatic punches

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may be synchronized through a cable attached to a Remington typewriter for remote control action of Powers punch keys by the stroke of typewriter keys. A customer invoice may be prepared on the typewriter, at the same time actuating the linked punch mechanism to produce an automatic punch card for the accounts receivable charge, an application which has considerable use in public utility billing.

8.8 The International Alphabetic Duplicating Punch

The alphabetic duplicating key punch not only performs all of the functions of the motor drive duplicating punch but in addition records alphabetic information in tabulating cards in such a manner that complete names, together with numerical data, can be subsequently printed by the alphabetic accounting machine. The tabulating operation requires the punching of two holes in a single column of the card if the printing of an alphabetic character is accomplished. The various designations are punched into the card by the following plan of double punching:

Combination Digit	12th Position	11th Position	0 Position
1	A	J	S
2	B	K	T
3	C	L	U
4	D	M	V
5	E	N	W
6	F	O	X
7	G	P	Y
8	H	Q	Z
9	I	R	

Any of the twenty-six combinations are automatically double punched in the proper card position by depression of the desired letter key in the keyboard. The punch proper is

a standard typewriter keyboard with the 10 numeric characters on the top row. A separate standard numeric keyboard is located at the right of the machine for use when alphabetic characters are not desired. The machine is equipped above the card bed with a duplicating rack in which master code cards may be used to reproduce two holes at a time in each duplicated column, if desired. The machine has an automatic card feed, ejection, and carriage return and is at once the most complete and versatile key punch ever devised.

8.9 The Powers Alphabetic Key Punch

This machine has all the features of the Powers 45 column punch, and other distinctive features as a universal punch for automatic recording of alphabetic and numeric perforations. The cutting action of the keys is electric not mechanical as in the 45 column machine.[40] The alphabetic arrangement of the keyboard follows standard typewriter sequence, and the numeric keys are located under the letters. As in the numeric machine, punching is delayed until the entire card is set up, when a trip key punches all columns at once, ejects the card and inserts a new one.[41] This machine is used only for 45 column cards, as the 90 column machine can be made an alphabetic punch by depression of two keys if greater capacity is required.

8.10 The Alphabetic Printing Punch

This punch is utilized when it is desired to punch alphabetic and numeric data into tabulating cards for subsequent tabulation in the alphabetic accounting machine.

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Simultaneously with the punching of each character a printed symbol for the letter or digit punched registers at the top of each tabulating card column corresponding to the punched holes which it contains. The alphabetic printing punch has a standard typewriter keyboard and is an especially valuable machine for use in systems which require considerable reference to the detail card tabulating card file. The condensed legibility positively identifies at a glance the information which is punched in the cards and eliminates all necessity of reading the holes.

8.11 Factors Which Govern Efficient Punching

Since the ultimate basis of any tabulating plan is the timely, fast, and accurate punching of proven detail cards cards from original documents, the attention that must be devoted to obtaining best punching results cannot be over-emphasized. The kind of machine used must be suited to the job. Female labor should always be used for punch operation. The physical condition of the operator must be good to produce satisfactory work. The design of tabulating cards should permit an ideal physical relationship to the sequence of data punched. All registration on original records should be clear. Punch operators should be provided with good light and favorable working conditions. The touch system of key operation should be employed. The amount of experience of a clerk has a direct bearing on the nature of her work, and she will only approach her best accomplishment after a year of steady work at the machine. The amount of manual punching with relation

to prepunched and duplicated fields has an important influence on volume of work. An operator must be familiar not only with the original documents which she uses but also with the system in general in order to accept punching responsibility. The matter of supervision and education of punch operators finally determines how fully their specialized ability may be applied.

9.0 General Differences Between International and Powers Tabulating Machines.

The major difference between the key punches of both manufacturers was liberally discussed. It is unnecessary for the purposes of this study to contrast further the specifications of Powers and International equipment. In discussing the other distinctive units of tabulating machines the International line will be chosen for illustration in all instances. This selection is no reflection upon the comparative excellence of Powers machines, but a few points of general distinction should be mentioned. The Tabulating Machine Division of The International Business Machines Corporation is the larger company of the two. It leads in number of customers, in variety of machines available, in universality of applications, and in pioneering of machine progress. The International Company has usually led the Powers Company in developing a new machine unit. A brief comparison is made to distinguish the difference between machine impulses obtained from the tabulating card in sorters and tabulators. The International selection is almost exclusively an elec-

trical circuit and the Powers selection is largely a mechanical action. In International sorters, a steel brush closes contact through the hole in the tabulating card against a steel contact roll, thus opening the throat of the proper track to lead the selected card to the chosen pocket as it feeds horizontally through the machine by rubber rollers. The selection impulse is thus determined by one electrically closed brush, which when cards are sorted on a specified card column, will distribute a card punched in that column to one of twelve pockets. In the Powers sorter, the selector has twelve pins to distribute the punched card to twelve pockets, and it follows that the pin which matches the hole punched in the card column determines to which pocket the card will sort.

Similarly, the impulse to actuate International tabulators is electrical. A printing tabulator is equipped with two brush plates, one for adding, and the other for automatic control or totalling at the end of control groups. Each brush plate contains one steel brush for each column in the tabulating card and by energizing through the hole in the tabulating card against steel adding and control rolls creates electric circuits which govern subsequent action in the machine. The basis for adding or control is electrical selection, determined by adding and control circuits established from one brush for each card position. An 80 column tabulating card requires 80 brushes in the adding brush plate and 80 brushes in the control brush plate. In the Powers tabulators, adding and control impulses are mechani-

cally derived by the engagement of pins in a translator with the punched holes of the tabulating card. There is one pin, or wire, for each position of each column, and the actuating impulse is derived as the tabulating card passes the base of the translator unit where with all wires pressing against the card, only the wires which match the punched holes in the card engage. The tripping of the cams which cause operation of the print unit is caused by the physical contract of the actuated wire of the translator.

The difference between International and Powers tabulators is chiefly the electrical and mechanical basis, respectively, of their operation. The International electrical basis is capable of greater flexibility in report form, as a change of report is effected without change of card form merely by changing the terminal wire from a card adding brush position to any of the many counter printing positions. The mechanical wiring of the Powers translator is fixed since impulses can follow only lines of physical transfer, but by matching the card fields for different reports with careful card design it is possible to use one translator for several different forms of reports. A translator is provided with more capacity than is required for any one report since its wiring accounts for every column in the card, so that the limitation is not as narrow as it might seem. What really occurs is the confinement of alphabetic printing to the portion of the translator used for alphabetic wiring and the matching of adding card fields and automatic control impulses

so that information in different card forms will print physically in the same machine counters. Wherever the card fields of different forms do not align for desired sequence of information in reports, the difficulty may be removed through use of more than one translator. In International machines the wiring for report setup is controlled by the electric wiring of demountable panel plugboards, in which insulated wires averaging a foot long are plugged between card position, control, selector, and counter hubs, resembling the plugging of a telephone switchboard. In the International panel plugboards the hub of any card position may be made to print in any counter position, providing complete flexibility. In either case, whether using translators or panel plugboards, the change from one report setup to another may be instantaneously completed by removing one wiring unit and substituting another.

10.0 Verifying Punches

The development of manual bookkeeping procedure was accompanied by the incorporation of detailed checking routines which had to be performed at each stage in the various recording and transcribing operations. This detailed checking doubles the volume of work performed. The mechanical verifying punch was originated to prove mechanically the accuracy of each punched detail card immediately following its preparation, establishing the correctness of the card, and all its future distributions, for all time. The punch is similar in design to the manual key punch, being operated by a standard key-

board of fourteen keys. The cards and original documents are received by the verifying clerk from the initial punch operator in the same sequence as first handled. The verifying operator inserts each card, maintaining former order and repeats the entire punching operation. As a verifying key is depressed a plunger comes up in the punch bed, engaging the hole and moving the card one space. If the key which is struck does not correspond to a hole punched in the card the carriage of the verifier does not advance, calling attention to an error. Comparison of the punched card with the original data then determines what correction may be necessary. The motor drive verifier, which was designed at the same time as automatic feeding and ejecting devices were developed for punching equipment, speeds the work of the operator. Skip bars are used in the verifier to correspond with the skip bars in the key punches and equalize column alignment. Last column verification is accomplished in the motor drive punch by the automatic ejection of the card. If desired a small "v" can be printed at the bottom of the card to mark each column verified.

11.0 The International Gang Punch

The gang punch was originated to expedite the repeat punching of data common to tabulating cards. The setting up of data and the feeding of cards is accomplished automatically in this machine. The columns to be punched may be set up in the die plate of the punch either from a

prepunched master card or by setting each column individually. The machine punches cards at a rate of 125 cards a minute. In this machine only one master card may be used in the die plate at one time, and the control can only be changed for gang punching another group of cards by manually raising the head, clearing the die plate, and setting up another master card. The machine is one of the least practical of all tabulating machines because of the lapse of time in changing the die plate manually.

12.0 Reproducing Punches

12.1 Functions of the International Reproducing Punch

The series of machines incorporating the reproducing principle illustrates how a family of related machines may be built around basic central ideas, and typifies the marked engineering advance of the past five years. The research laboratory of the International Company is constantly at work experimenting with improvements in former equipment and building new devices in anticipation of expanding present markets or uncovering new ones. The expense of this research is over $1,300,000 each year, but this cost is only minor when compared with the terrific obsolescence which is automatically created by the laboratory staff when proven, revolutionary machine changes are incorporated into new production.[41a] The reproducing punches perform more quickly and more automatically most of the functions which were previously performed by the duplicating key punches and the motor drive gang punches. All, or any part of, the information which has been punched in

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one set of cards may be reproduced into another set of cards. Information may be automatically copied, or gang punched from several master setup cards into as many groups of interspersed detail cards, all in the same run; setup changes automatically take place in the machine as each new master card passes into the punch mechanism.[42]

12.2 Description of the International Reproducing Punch

The machine as a whole is composed of two units - the reading unit and the punching unit. The source cards which are punched are placed in the reading unit card feed to actuate the punching mechanism, and the blank cards to receive the punching are placed in the punching unit card feed. For all operations cards are placed in the feed hoppers face down, with the top edge toward the feed rolls. The card feeds of both units are synchronized, the feeding time of one card being regarded as a card cycle, and the speed of the machine is 100 cards per minute.

In reproducing, both units operate simultaneously and the reading unit transfers directly to the punch magnets of the punching unit in a totally flexible manner so that a specific column in the reproducing card may be punched in any desired column of the reproduced card. It takes eight seconds to punch an 80 column card by horizontal travel in the duplicator. It requires less than two seconds to punch one card cycle in the reproducer, since all the twelve punching positions in the card are punched

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vertically, - the "12" positions first, the "11" positions seconds, and so on to complete 12 stations of the card cycle.

When gang punching, only the punching unit is used. A series of different master cards interspersed with corresponding detail cards is fed into the punch. Each card secures its machine punching impulse from the card preceding it. Each master card is punched with an 11th or "x" position, but the detail cards are not punched "x". Accordingly the master card following the last detail card of the previous group will not be affected by this card, and will change the setup to correspond with its own setup. This principle inaugurated the automatic control gang punch, displacing a formerly slow, manual operation with one which was very fast. The punch unit requires setting of one punching x brush to correspond with the x in the master cards to make the machine control automatically as a gang punch.

Information may be optionally selected from one of two punched fields of the source cards and copied into one punched field in the reproduced card. Conversely, information punched in a single field of source cards may be copied into either one of two fields in the reproduced cards.

12.3 <u>The International Comparing Reproducer</u>

This machine, in addition to performing all the operations of the International Reproducer, accomplishes several card comparing operations. Two identical sets of punched cards are checked for agreement with each other. The card for card comparison is automatically performed and the

machine stops when dissimilarity in punching occurs.[43] This comparing function is made possible by inclusion of a comparing circuit in the reading unit of the machine.[44] In reproducing operations, when control punching appears in both the source cards and the cards to be punched, an automatic control is established between the two sets of cards to ensure that the new punching is placed in the correct cards. The machine stops if a break occurs in identity of the two sets of control numbers. Furthermore the reproduced cards are automatically verified, for if any discrepancy occurs between source cards and newly punched cards, the machine stops.

13.0 <u>The Operation of Sorting Machines by Tabulating Cards.</u>

13.1 <u>The Function of the Sorting Machine</u>

All accounting systems require a basic classification to unit records. Without some rapid means of accurately sorting tabulating cards into subdivided groups of like identity there would be no widespread industrial use of punched card accounting. In the discussion of sorting machines, the second major machine absolutely indispensable to the needs of a tabulating system is presented. Regardless of the type of punch used as the basic recording medium, one universal type of sorter, with numerous optional attachments for suiting special requirements, is available for classifying tabulating cards. This machine automatically arranges tabulating cards into numerical order, into groups of like

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classification or other predetermined order. The speed of sorting is 400 cards per minute and the machine may be fed while in continuous operation, actually sorting 24,000 cards an hour if there is no interruption. One clerk can easily operate two sorters and one or two tabulators, simultaneously and efficiently in a bulk job in which maximum operating capacity is necessary at all machines. Thirteen pockets receive the cards during the sorting process, one pocket for each of the twelve punching positions in an individual card column, and one pocket for rejected cards unpunched.

13.2 Operation of the International 80 Column Sorter

The horizontal 80 column sorter is a machine 61 inches long by 16 inches wide by 45 inches high. The machine has a card feed bed with capacity for holding about 1200 tabulating cards at the extreme right and cards are fed into this magazine face down. Upon classification by passing through the throat of the machine, cards being sorted in any column position are distributed to any of thirteen pockets. From right to left, facing the machine, pockets are labeled R, 12,11, and consecutively from 0 to 9. The "R" signifies rejection and catches all cards unpunched in any position of a particular column being sorted. The other twelve pockets correspond to the twelve punching positions in a tabulating card column. Each pocket will hold approximately 600 cards and is equipped with an automatic stop so that it will not overflow when in operation and jam the machine. The pockets are covered with a continuous safety

glass shelf supported by a steel frame. Sorting racks for storing sorted cards, containing thirteen compartments holding about 3600 cards each, are located above the glass shelf behind the machine. The sorting of the punched holes of any card column into the thirteen pockets is accomplished by locating the steel sorting brush in the desired column by a fast adjusting motion which sets the brush holder. An 80 division sorting panel for quick location of columns to be sorted corresponds to the 80 columns of the tabulating cards. When the machine operates two knives engage a single tabulating card and convey it with a forward motion through the sorter throat; the steel sorting brush makes contact against a metal roll through the punched hole in the card and automatically determines into which of thirteen pockets the card will fall. The closed contact causes the dropping of the proper chute blade to receive the selected card, which moves forward to the proper pocket by carrier rolls.

13.3 <u>The Method of Sorting</u>

There are three infallible rules to perfect sorting procedure in the representative case. First, control fields should be sorted from the most minute subdivision toward the most comprehensive. In the sorting of customer sales of a branch office, by location, salesmen, and lines, card column fields would be sorted in the following sequence: line of goods, customer, town, state, and salesman. It is always easy for a beginner to confuse columns when sorting, yet if control groups are successively handled so that the sequence follows from

the least complex to most complex group, no difficulty will be experienced. The same relationship may be pictured by visualizing from what control groups in the finished report minor totals, sub-totals, and grand totals are to be obtained. Seconds, card fields are usually sorted in numeric sequence from right to left, or from units column to tens, tens to hundreds, etc. It might appear more logical to start sorting each card field in its extreme left column, but if each of the 10 stacks of cards sorted on the thousands column were sorted on the hundreds column, the 10 stacks would become 100, etc. It is obvious that as the sort progressed from left to right, the problem of physically manipulating small packs, the loss of time in card storage, and the waste of machine running time by needless column changes, would intensify the confusion. Proceeding from right to left automatically returns perfect numerical order in the sorting operation in a simple and effective manner. Third, cards should always be needled on the previous column when being fed into the card hopper after the sorting column has been changed one position. This needling detects any missorting of the machine, a rare difficulty, but locates large groups of cards which may have been misplaced when stacking the sorting racks with cards removed from the pockets in the previous operation. "Needling" consists of running a metal wire about six inches long through the uniform perforations in individual card positions to identify by the click of the needle against the glass shelf that cards are the same.

The needling is a simple device to regulate with positive control the entire accuracy of the sorting operation.

13.4 Alphabetic Sorting

To arrange cards containing names into alphabetic sequence requires double sorting of each column, since each letter in International Machines is recorded by two holes in a single column - one of which is 12, 11, or 0 and the other of which is a digit from 1 to 9. The cards are first sorted normally according to the digits from 1 to 9.[45] In a second operation, the selector switches corresponding to these pockets are moved to the center of the commutator, which permits sorting of the 12,11, and 0 positions on the re-run.[46] The cards falling in the 12 pocket will contain letters A to I in alphabetic sequence; those in the 11 pocket, the letters J to R; and those in the 0 pocket, the letters from S to Z.[47] A special switch can be installed on the sorter to eliminate necessity for changing position of selector switches manually after each sorting operation.

The commutator of the sorter is an electrical mechanism containing 12 individual switches, circumferentially arranged about a common axis, which is timed to rotate with the feeding and sorting of cards. Each of 12 selector switches corresponds to one of the 12 pockets in the sorter, which makes it possible by adjustment of the commutator control to lock out individual pockets, causing cards to reject. If it were desirable to sort the 3 group of any column without changing the order of the cards, all switches but the 3

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selector would be locked out in the commutator. When cards run through the machine the 3 group will sort into the 3 pocket, and all the other cards will reject.

13.5 The Counting Sorter

The card counting sorter is designed to count the holes punched in any or all positions of a given card column, and also to register the number of cards not punched in the column. It is also a standard 80 column horizontal sorter. The counting mechanism has fifteen adding counters of 5 digit capacity each, arranged as follows: 12 counters, one for each of the 12 punching positions of the card, 1 counter for unpunched rejects, 1 counter for sub-total of number of cards, and 1 counter for grand total of number of cards.[48] All counters may be cleared in a single operation. This machine has many valuable uses for statistical purposes.

14.0 The Engineering Features of Tabulators

14.1 The Function of Tabulators

Just as the first tabulator was constructed by Dr. Hollerith for rapidly and accurately compiling the 1890 census, the modern electric accounting machines have been especially designed to meet the demands of management for varied as well as timely and accurate information. Punched card equipment was created for accounting purposes primarily, concerned chiefly with the classification of transactions, the summarization of like transactions, and the complete analysis of data over a wide range of controllable factors.

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The major function of tabulating machines was the preparation of complete final reports from proven punched cards by use of automatic machines, which eliminated most of the time consuming operations which are indispensably necessary in other routines.

Punched tabulating cards are automatically fed at a speed of 150 cards per minute from a card magazine, and in their course through the machine actuate various counters, in which gross and net amounts accumulate. A group sensing device called "Automatic Control" stops the machine by comparing punched classification of each card feeding through the control mechanism with that of the previous card.[49] When the card classification changes, the machine stops. The feeding of cards is temporarily discontinued to allow the machine to print automatically the group identification code and totals, clear the amounts automatically from the counters, and space the final printed report so that the totals of the following group appear on the next line. Totals may be subdivided so that a report may automatically be prepared with minor intermediate and major totals. By means of a control switch, totals only may be printed or the printing mechanism may be set to list each card at a speed of 70 to 120 cards a minute. Various printing capacities up to 88 characters may be registered simultaneously on a single horizontal line, depending on the size and construction of the print unit.[50] This permits the recording of more than 125 characters when

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full capacity of the machine is used, whereas the average person can write only three characters a second with pen or pencil and a highly trained typist depresses no more than 12 keys per second.[51]

14.2 Gradual Progress of Engineering Development

The perfection of individual machine devices in rendering the tabulator a fully automatic mechanism capable of our specialized modern uses, required nearly 40 years. Each change meant an engineering achievement in itself, which was at once incorporated into all future production and contributed its part toward expanding the utility of the tabulator and punched card accounting in general. Many of the changes were so drastic as to render obsolete at one stroke the entire line of machines installed in the field, illustrated by the announcement of 80 column machines to supersede 45 column equipment. It should be kept in mind during the subsequent discussion of development of tabulators that solution of the many problems came slowly, methodically, and successfully, with continued enlargement of the application of electrical, engineering and designing principles. To convey some notion as to the effects of the successive changes, the different principles will be described in rough sequence of their origin.

14.3 Explanation of Tabulating Principles

14.31 Automatic Card Feeding

The earliest tabulating machine permitted the feeding of 50 to 80 cards a minute from a hand-operated press,

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but the automatic feed mechanism increased this speed to 150 cards a minute.[52] Cards feed down from the magazine into the machine by a combination of picker-knives, which engage the card at the top, and feed rolls guide the card movement past the brush plates. Electrical circuits are completed by steel brushes as they establish contact through punched holes against contact rolls. Automatic feeding and tabulating are accomplished by a drive motor controlled by a start and stop button located at the front of the machine. Depressing the start button causes feeding of the first card, after which tabulation will continue automatically until the last card is added. Stopping at predetermined intervals at the end of group classifications was accomplished in early models by use of stop cards about the same dimensions as the tabulating cards themselves. Totals were read from visible counter dials, transcribed, and the tabulator was again starting by depressing the start button.

14.32 Counter Units

Each counter unit of early tabulators consisted of nine adding wheels, driven by a mechanism actuated from the tabulating card. Amounts as large as eight digits could be introduced directly into the counter from the punched holes; the ninth position was for accumulation of 1s from the adjoining direct adding position. The totals in counters were visible through a glass window. The capacity of the machines was four or five counters.

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14.33 Plugboards

In the first tabulators, machines were especially constructed for the type of work they were to perform. Brushes for individual card columns were permanently wired to the predetermined counter positions in which accumulations were to appear. This method of setup was limited and inflexible, and was followed by a mechanical relay unit which permitted a wider variety of tabulation by varying card columns which could be added in specific counters. One of the most important elements in the evolution of electric accounting machines was the permanent adoption of the plugboard. The plugboard is a special panel, incorporating the idea of the telephone switchboard, containing one series of hubs for the card columns and a series of hubs for each counter position. Any desired combination of results of the tabulation may be achieved by inserting movable wire connections from any column of the tabulating card to any counter position. This is a completely flexible arrangement, enabling the planning of any report form without limitation. Changing the machine from one report setup to another requires several minutes, as usually all wires should be completely stripped before wiring the new setup. For straight tabulating work, with subsequent transcription of the counter totals by writing on control sheets, the plugboard is a simple arrangement and change of setup is infrequent.

14.34 Counter Clearing and Accumulating Collar

Counters were cleared in the first machines by

rotating a hand crank. Each counter was engaged to a shaft by means of a collar clutch. The crank method was discarded by using a special clearing or reset motor governed by an operating key on the front of the machine, next to the stop and start keys. Depression of the reset button results in the clearing shaft being turned by the reset motor.[53] Individual counters can be made to accumulate sub-totals or to clear, at the end of each reset cycle, according to the report the operator is running. Cards may be tabulated for a single grand total or according to groups and sub-classes.

The reset key should be depressed before operating the machine to insure that all counters have been cleared to 0 position. When major and minor classifications are desired in a record from cards sorted in groups, the sorting clerk places a stop card after each minor group and two stop cards after each major group. In tabulating, the operator transcribes minor totals every time the machine stops and then depresses the reset button. Whenever the machine stops immediately after resetting, it indicates that a second stop card has appeared, requiring the operator to copy the amounts from counters accumulating major totals and close their clearing collars before resetting to tabulate the next group.

14.35 <u>Group Indication</u>

All electric tabulators are equipped with a group indicating device for indicating in one or more counters the classification code numbers of each group of cards that passes through the machine. This principle is in reality

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first card identification, so conceived that the identifying code numbers of tabulating card groups will not totalize like the adding values. It is possible to arrange counters to permit use of some of the wheels for adding and some for indicating, according to any desired split. When running a classified report it is absolutely essential that identifying or indicating information be plugged through the group indicator.

14.36 Automatic Control

The automatic control tabulator is an especially valuable unit since it consolidates most of the approved features of the first engineering and eliminates one of the chief objections of the electric tabulator. Stop cards are entirely eliminated, and the machine stop automatically at the end of each group classification.[54] The automatic control tabulator has two sets of brushes, the upper set for control and the lower set for adding.[55] Automatic control is effected by electric comparing circuits between the two sets of brushes.[56] When tabulating sorted cards, any card which is out of place causes a break in control and the counter used for group indication shows the classification in which the total should be registered. When one card passes the lower or adding brushes the card behind it is passing the upper brushes, and these and successive cards will add without control break so long as the classification does not change. Whenever the new control group appears in a card passing the upper brushes, the machine flashes an automatic stop signal. The automatic control tabulator has major and minor control and will function

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on two different control group fields simultaneously.

When plugging the tabulator panel for automatic control, the adding brushes are led into the first row of hubs in the automatic control unit. From the second row of hubs, wires are led to the counter positions, causing the control group to indicate and identify each division. The degree of control, whether minor, major, or both, is always manifested by plugging the minor or major shunt plugs, or both, in the third row to the extreme left of the control fields which they represent. Wires are led, to complete the control circuit, from the control brushes to the fourth row of the control unit.

14.37 The Electric Accounting Machine

A printing mechanism capable of printing automatically into finished accounting report form was developed simultaneously with automatic control.[57] The printing tabulator with automatic control was at the time of its development the ultimate achievement of engineering and research brains and it opened such far flung possibilities of expansion that emergency manufacturing schedules ran far behind orders. The name "tabulator", which had become linked with the manual transcribing of final results from visible counter dials to reports or control sheets was necessarily changed to "electric accounting machine" to represent the broadened scope of the new automatic unit.[58] The manual transcription had been accompanied by illegible entries, transposition of figures, and outright errors, as well as being a slow operation. The

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printing mechanism advanced the speed, economy and precision only obtainable by automatic operation to the final stage of the accounting process, in the form of finished printed reports, mechanically prepared. The multiplicity of uses to which the electric accounting machine could be put immediately gave rise to certain special problems and frequent changes of design were necessary to incorporate desirable new features into the machine. These many improvements have been combined as standard equipment in present machines in many cases, and in other instances various optional devices are available to fill specific demand.

The printing unit of the electric accounting machine may be actuated from punched holes in tabulating cards to list detailed information from each card or to register figures obtained from control group totals in the counters. Whether the machine is set for list or for total, the accumulation of the figures, the clearing of the counters, and the printing of results is an automatic and continuous operation, since the printing unit is synchronized with the automatic control mechanism of the tabulator. The printing unit indicates on the report form the classification data of each control group, transcribes totals of control groups to the reports in printed form, and lists, if preferred, the complete detailed information recorded on the punched cards.

The printing mechanism of the electric accounting machine is built on an extension at the right end. It is composed of a single row of type bars arranged in groups of 10

called "Print Banks". Five or seven banks of type are provided for the five bank machine. The five counter seven bank machine has five banks of type corresponding to the counters and two banks of type at the left which can be used only for group indication and listing. The bar at the right end of each counter print bank is reserved for an asterisk to distinguish totals from detail items. The remaining type bars, as well as those in the list bank, contain numerical type from 0 to 9. The type bar at the left of each counter print bank cannot be used for detail listing, since it is actuated only from counter totals to print accumulated carryover in the ninth position. Printing of individual type bars may be suppressed by setting hammer-lock levers, one for each type bar. It is usually desirable to provide an intervening blank space to segregate indication fields, for otherwise coded fields would be run together in one continuous series of digits which would be difficult to interpret. A type bar will print either a significant figure or a "0" unless suppressed by a hammer-lock.

The report form is fed into a paper carriage similar in appearance to a typewriter carriage. The carriage supports a rubber platen, and the registration of tabulated figures is obtained on the report form by the electric stroke of type bar positions, against a continuously fed reversible ribbon, onto the hard registration area provided by backing the paper with the platen. Forms may be fed singly, in continuous folding series, or in rolls, and the carriage will

accomodate sheets up to a width of 20 inches. Standard typewriter spacing is provided, six single spaces or three double spaces vertically to an inch.

The electric accounting machine has switches located at the front of the machine for auto start, stop, auto reset, minor control, major control, total print, tabulate - list, and counter control. Separate list switches are provided for each counter and in accordance with settings of the counter switches the data introduced into the counter will add and not print, add and print, indicate the first card, list each card, or accumulate progressive totals.

14.38 Controlled Counters

It should be kept in mind that the present discussion is mainly concerned with general machine principles and revolutionary developments caused by totally new or improved engineering, rather than with description of any particular electric accounting machine unit. One of the most important developments in recent engineering has been the controlled counter. The unit is so constructed that amounts appearing in a single group of cards may be added, subtracted, or eliminated in the accumulation of net totals. This control is established for each tabulating card as it enters the machine.[59]

An appreciation of the merits of controlled counters is best appreciated by comparing them with adding counters from a consideration of the means of obtaining net figures. Subtraction amounts were punched in tabulating

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cards as late as 1930 by recording the data in complement, which followed the subtraction procedure in leading types of manually operated calculating machines. Since the complement of any number is its negative counterpart, which when added to the number itself will produce unity, the complement punching of $283.46 would be registered in the tabulating card as 999716.54 The three 9s at the left of the significant figures are necessary to clear the unit entirely out of the eight position counter, unless one limits the counter capacity by locking down any of these hammers so that the counter will not print the meaningless carry-over digits. This complement punching permitted recording of gross amounts and subtraction amounts in the same card field, enabled the plus and minus cards to be tabulated together in the same machine run, and produced net amounts on the reports.

In the controlled counter, or "balance" counter, necessity for complement punching is entirely eliminated. A balance counter is termed "controlled" because it operates in accordance with a specific impulse to add all cards, to add only certain cards, to subtract only certain cards, to compile net results by deduction of credits from debits, or to eliminate altogether.[60] In other words, the counter is electrically wired to receive the desired combinations of plus, minus, and control impulses. A specific section of the plugboard is reserved for counter control wiring, as distinctly apart from the adding circuit which leads directly from the adding brush or card column positions to the

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counter adding and printing positions. So completely flexible is the counter arrangement that unless the counter is told what to do by a control impulse, it will be entirely inoperative. The registration of credit balances from cards punched in complement in adding counters of machines not having counter control is the identical printing in complement from the machine counter, making it necessary to convert or interpret the complement result to derive the true figure. In the balance counter, however, both debit and credit amounts are printed in direct figures. In International machines a credit balance is indicated by the symbol "CR" at the right of the units digit, in Powers machines, the credit amount shows as "-".

14.39 The Automatic Plugboard

A most welcome and especially valuable contribution to saving of time, machine economy, and labor cost was the perfection of the demountable automatic plugboard. It had always been necessary to wire a plugboard panel of an accounting machine to perform a particular job every time the kind of machine work changed. This requisite of machine setup, proving the wiring, running a report, tearing down wiring, and plugging a new setup consumed much working time and constituted a real handicap to gain satisfactory performance from an otherwise automatic accounting machine. The demountable panel plugboards of recent origin permit instantaneous change from one kind of work to another. This arrangement is ideal from operating consideration. The

earlier panel plugboards were bulky bakelite mountings found usually at the base of the machine, awkward to get at, and wasteful of operating time through frequency of changes.

The new removable plugboards are compact panels, arranged in properly labelled sections, pierced on the upper side with hubs for wiring all card impulses. The under side of the panel contains a wire connection for every hub represented by a wiring hole on the face side. Wires are inserted in the hubs to control a certain machine report. The panel is fitted into a slotted slide of the machine and is mechanically shifted into true position by a lever, with every connecting lead of the bottom of the panel contacting its particular corresponding wire permanently arranged in the wiring bed of the machine. Thus, the plugboard itself, completely detachable from the accounting machine and wholly flexible for any possible combination of column wiring from the punched card, may in a few seconds set up the machine for the most complicated kind of report. In practice customers will utilize several demountable plugboards, some of which will be individually used for work of only one kind, and others of which will be free flexible boards to be changed and set up in operator's time without interrupting continuity of machine running time. Whether a separate board will be permanently reserved for a distinctive kind of report is determined by the frequency and complexity of the report and its relation to the flow of other reports and the frequency of change in machine wiring. It is now possible for one accounting

machine to be used for an indefinite number of different reports, all run in the same day, with instantaneous transfer from one kind of wiring to another.

14.40 The Significance of 11th Position or "x" Control

Several times up to now, it has been stated that the punching of the 11th position or "X" position in the tabulating card is usually concerned with control. In the reproducer, the punching of the X position determines the automatic changing of machine setups of consecutive master cards interspersed with detail cards in continuous gang punching. In sorting, the X position is used to separate debits from credits. In tabulating, the X position is used for a multitude of automatic purposes. For instance, in running an aged accounts receivable trial balance the automatic influence of a score of X positions may be exercised in distributing overdue balances into three different printing banks to classify the amounts owed as 1-30 days overdue, 31-60 days overdue, and more than 60 days overdue. Generally speaking, and from a tabulator impulse, a particular card is either an "X" card or a "no-X" card, according as it is punched or unpunched in an 11th position. The presence or absence of the X will cause a card to add, subtract, divert to another counter, eliminate altogether, or to affect or fail to affect some other X impulse. In other words, the automatic guidance of how the adding fields in the tabulating card will react when run through the tabulator is governed wholly by the X control position.

14.41 Class Selection

It often becomes desirable to divert to different machine counters information which may be punched in the same card field. A common illustration is the differentiation between debit and credit transactions, tabulated in different counters and the process is known as counter selection. In materials distribution, for example, the quantity received might be punched in a receipts card in columns 74 through 80 and quantity issued might be punched in a requisitions card in columns 74 through 80. Obviously, if receipts and issues cards are tabulated together with no means of distinguishing between matched fields the two sets of cards would add together. The issued cards are, therefore, punched X in column 80 to identify them from receipts cards. The card impulses are wired through a class selector, which is a triple row of hubs, 10 in each row, actuated by one of two common hub positions for the control impulse. The top row is for no-X impulses, the middle row for X impulses and the bottom row for common impulses. The wiring circuit is simple and effective. The class selector is actuated by plugging one wire from column 80 of the control brushes to the control position of the class selector. The adding brushes, columns 74 through 80, are wired to the common hubs of the class selector, thus bringing both the no-X or receipts impulses and the X or disbursements impulses into the circuit. The no-X impulses are wired from the top row of the class selector to counter 4 and the X impulses are wired from

the middle row of the class selector to counter 5. When the cards feed through the tabulator, every X card, or requisition, energizes the middle row of hubs by closing a contact operated by X-80, thus diverting the credits; every no-X card is unaffected by the class selector as the selection contact remains open. Stated concisely, both debit and credit impulses pass through the class selector through a common row of hubs; debit impulses leave the class selector from the top row of hubs to a debit counter, being unaffected by the electric circuit, credit impulses leave the class selector from the middle row of hubs to a credit counter, since an electric circuit, because of their X punching, prevents them from accumulating with the debits and creates a separate path for the credit impulses to travel.

14.42 Field Selection

Class selection may properly perform any of three specific functions - counter selection, field selection, and field elimination. Only machines which are equipped with class selectors or balance counters can perform the functions of class selection. Field selection is generally considered to be the reverse of counter selection. The purpose of field selection is to combine data from different card fields by plugging through a common class selector causing the information to accumulate in a common machine counter. One of the two card fields would be X punched and the other would be no-X punched, and both the X and no-X impulses would be wired through the same class selector, controlled by X-80.

The X punched field would be wired from columns 74 through 80 of the adding brushes to the X hubs in the middle row of the class selector. The no-X field would be plugged from columns 47 through 53 of the adding brushes to the no-X hubs in the top row of the class selector. The common hubs of the class selector would be tied to the hubs of counter 4. In this instance the adding or subtraction impulses of one machine counter come from two different card fields.

14.43 Field Elimination

This adaptation of class selection provides for omission from the machine counter of certain data that may be punched in the card field. In a tabulation of both X and no-X cards, either kind of cards may be eliminated by not wiring its respective impulses from the class selection, although both X and no-X impulses pass through the class selector through the common hubs.

14.44 Counter Linking

It frequently happens that group totals will be required in a tabulation as well as detail totals. This would be accomplished by wiring the detail information to add, print, and clear on minor control and the group information, on major control. The adding values of the group information must be prevented from clearing when the detail information clears, yet the group data must come from the same punched field as the detail data. If it were necessary to obtain a report of materials issued by department and by machine center within the department, then columns 74 through

80 would be plugged to counter 4 for the detail distribution by machine center, and counter 4 would be wired, or "laced" to counter 5 to accumulate totals by department. In this manner, columns 74 through 80 directly influence the impulses accumulated in both counters. This illustration brings out the principle that machine plugboards provide duplicate hubs for each position in all strategic points like counter hubs, class selection control positions, and X-Distributors for multiple plugging so that the nature of a particular impulse can be transmitted through the machine to influence several counters all at once. This type of progressive wiring is known as multiple plugging.

14.45 X-Distributors and Direct Subtraction

In the most modern accounting machines, the combined plugging of X-Distributors and balance counters control the direct subtraction circuit. The individual X-Distributor is a device, based on the principle of ordinary class selection, for the purpose of selecting counter control impulses so that different classes of cards may be added, subtracted, added and subtracted together to obtain net figures, eliminated, or transferred by the counter. It consists of five groups of three position class selection relays, actuated from counter control positions. In each of the five X-Distributors a spring action normally holds the common and no-X contacts together. The entry of a properly X-punched card energizes the relay magnet of the distributor, causing the contact between common and no-X to be broken and the contact between

common and X to be made. This is nothing other than the basic class selection principle, only instead of providing 10 hubs for each X, no-X, and common position of each selector, the individual X-Distributor has only one X, no-X, and common position. Each X-Distributor, however, has duplicate hubs for each of the three positions for multiple plugging to affect other X-Distributors.

An example of direct subtraction will indicate how X-Distributors are used in relation to balance counters. Suppose that sales and sales returns are punched in columns 15 to 22, that sales returns cards are differentiated from sales cards by the punching of X-22, and that it is desired to tabulate a report of net sales in counter 4. X-Distributor 1 is used to segregate the X and no-X impulses, controlled by X-22. The adding brush positions of columns 15 through 22 are plugged directly to counter 4. A wire is plugged from column 22 of the control brushes to the control position of X-Distributor 1. The common hub of X-Distributor 1 is plugged to a counter control impulse, a step which is always necessary to ensure that both X-punched and no-X cards pass through the circuit.

Diverting for a moment, each balance counter has both a plus side and a minus side for control purposes and may also be used for straight adding without combination with X-Distributors. In plugboard panels, counter control hubs for regulating counter action are segregated in a control

section governing different activities, and each of the five or seven machine printing banks has its own horizontal row of control hubs. The control divisions of a counter, in horizontal order of hubs across the panel govern,

(1) Add hubs, when all cards are to add
(2) Add plus cards, in an X-Distributor circuit
(3) Add minus cards, in an X-Distributor circuit
(4) Balance control hubs, to cause printing of plus and minus balances or positive totals only
(5) List control hubs of plus totals only
(6) Symbol control hubs which determine various combinations of printing the left hand and right hand type bars.

Returning to the example of the direct subtraction circuit, the X control hub of X-Distributor 1 is plugged to the minus side of counter 4. The no-X hub of X-Distributor 1 is plugged to the plus side of counter 4. Although the sales return card is punched direct for the credit amount, the circuit caused by the X-punching results in conversion of the direct amount to an automatic complement every time an X card passes through the machine. If the final net total is a positive one, the result will show in normal direct figures. If, however, the net result is a credit balance, the figures will appear in the counter in complement and may optionally be printed on the report as a direct figure marked with the symbol "CR" to show negative identity or as the complement registered in the counter. Summarizing the direct subtraction circuit, it is emphasized that the wiring is simple and efficient, since it is only necessary to bring together the impulse from the control brushes which

determines the X and no-X cards, plugged through an X-Distributor, to cause both the plus and minus sides of the counter to be operative in the same run of cards in establishing a net positive or negative balance. The principle is well illustrated by pointing out that without an automatic means of computing complements for subtraction cards, it would be necessary either to punch complements manually or tabulate debits and credits separately. The term "direct subtraction" is possibly a misnomer, for although a mechanical means is afforded for printing negative balances directly, the process of determing deduction values is in reality complement addition.

14.46 The Principle of Summary Card Punching

There are many occasions when it is necessary to balance forward an entire report for use in preparing accumulative figures or to lessen significant card volume in report periods when it is advisable to eliminate peaks of machine running time. Up to a few years ago it was always necessary to punch summary cards manually from tabulated reports, involving considerable punching labor and verification. Summary punches were introduced about six years ago which enabled automatic duplication of the report itself through machine punched summary cards, simultaneously with the preparation of the original report. The summary punch is a separate machine, linked with the accounting machine through a cable, and actuated from the information in machine counters to punch into blank cards the exact values at the end of each automatic control group before the tabulator clears.

In the summary punching operation, the automatic control mechanism, the automatic stopping with totals in the tabulator, the transfer of control to the summary punch to perforate the summary cards, the printing of the totals and clearing of the machine counter, and the automatic starting of the tabulator to run the next group are all electrically determined in a perfectly timed operation. This arrangement is an ideal example of the tremendous progress achieved in tabulating machine engineering in the last few years. In fact, it is only within the last few months that high speed summary punches were designed with a speed six times as fast as the originally devised summary punch.

14.47 Summary

The foregoing principles represent the major accomplishments of tabulating machine engineering, of which the most outstanding and revolutionary discoveries were the development of automatic control, the print unit, the reproducing sequences, class selection, the balance counter, and direct subtraction. Comparison at this point of the early manually fed and cleared non-printing, non-listing tabulator, with no control with the highly ingenious, completely automatic printing accounting machine of today reveals not only extreme scientific advance in rapidity of change but, as well, the comprehensive nature of each change which spread machines over world markets in an ever accelerated adaptation to new uses and to more complete mastery over old ones.

15.0 Types of Tabulators

15.1 Determination of Machine Specification According to Use

It is not the province of this study to describe in any detail the specifications of any particular type of accounting machine. Rather it has been the intention to discuss through the evolution of the accounting machine itself those features which lend the equipment so admirably adapted to the almost effortless automatic compiling and analysis of accounting data, in comparison with the prohibitive costly and ineffective means of accomplishing the results of punched card systems by any other known method. The particular units of equipment needed for a job are determined by the nature of the work to be done. A certain requirement might involve use of a non-list tabulator with no control, but with adding speed of 150 cards a minute, purely for statistical work or verification. The demand might be for a seven bank numeric printing tabulator with listing speed of 100 cards per minute, adding speed of 150 cards per minute, 10 position counters, three class selectors, 4 balance counters, and three controls. Again, the job might need an 88 type bar alphabetic printer, with 43 bars alphabetic and numeric and 45 bars numeric only, speed 80 list and 150 tabulate, and counter arrangement built to provide 4 two-position counters, 4 form-position counters, 4 six-position counters, and 4 eight-position counters. Various special devices are available for use in accounting machines, not standard equipment but optional for particular

purposes. Machines are available for handling fractions. An automatic carriage may be obtained in connection with continuous form stationery to skip section headings of individual sheets for registering totals only on consecutive significant report lines without stopping the machine to adjust alignment. Numeric accounting machines are delivered in customers' offices in uniform bases which regardless of customers' specifications are so flexibly standardized that the machine can be changed by field adjustments into a unit of greater or more limited capacity to avoid the inconvenience and expense of removal and replacement of equipment as customers' requirements change. With intentional thought to avoid further technical reference to individual accounting machine units, a brief comparison should be made between numeric and alphabetic tabulators.

15.2 International Numeric Printing Tabulators

The two major types of numeric accounting machines are similar in operating principles but differ in appearance and capacity. Both types are numeric printers, are capable of direct subtraction, use the same automatic plugboard and can be supplied with summary punch attachment. Type 285 is available in 3,4,5,6, or 7 print banks and 2,3,4, or 5 counter banks. Adding counters have 9 positions, 8 adding and one accumulating.[61] Listing and tabulating speeds vary according to specifications as follows: 75/75, 75/150, 120/120, 120/150, the list speed per minute being the first figure mentioned, and tabulating speed the second.[62] Type 285

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is the accounting machine most widely used, since this model number includes individual machines with graduated capacities from 3 print units up to 7, for operation at different speeds.[63] Type 297 is the largest capacity numeric tabulator, and while it has only 7 printing banks, it contains 6 counters of 10 positions each. It has 3 control classes against 2 in Type 285. The speed of Type 297 is 100/150.[64] Numeric tabulators are used in those installations in which the identity of unit and group classifications punched into tabulating cards may be governed entirely by the adoption of numeric code or account numbers. The numeric account number serves as the posting medium to identify distributions which correspond to account classifications in the general ledger. In many instances, however, numeric reports must be decoded in order to interpret whole names, letters, and fractions. Sometimes instead of manually decoding a finished tabulating record by hand writing or typing, addressograph machines are used to print alphabetic information, as in the tabulating applications of preparing payroll checks and of sending monthly statements to customers.

15.3 <u>International Alphabetic Accounting Machines</u>

Alphabetic accounting machines constitute the most recent development in the International line. They have been on the market for the last few years, and it is only within the last year that the alphabetic summary punch was possible to render the alphabetic line wholly automatic in the same degree as numeric machines. This was real progress

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The major contribution of the alphabetic machines is the printing of complete alphabetic descriptions from punched tabulating cards. Inasmuch as alphabetic type bars not only contain 26 letter positions but also the ten digits from 0 to 9, the alphabetic printing section may be used either numerically or alphabetically.[65] Inasmuch as the operating functions of the alphabetic machines are vitally comparable with those of numeric equipment, it will not be necessary to consider alphabetic machine operation in detail, notwithstanding that design does not resemble outwardly the numerical accounting machine and that much of the internal mechanism has been modified to permit greater flexibility. Certain differences of major consequence will be briefly described.

In the largest capacity alphabetic printing there are 88 type bars and 80 counter positions.[66] The printing mechanism is divided into two solid banks of type bars, separated by a space equal to one type bar. The left type section has 43 alphabetic or numeric bars and the right type bank has 45 bars for printing numeric data only.[67] Each of the 80 counters is a balance counter which can either add, subtract or eliminate.[68] Unlike numeric machines in which counters are provided in independent units of nine or ten positions, the adding mechanisms in the alphabetic machine consists of a series of single position accumulators, arranged permanently in various multiples of two to provide counters of varying capacities. The 80 accumulators are

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subdivided into 4 two-position counters, 4 four-position counters, 4 six-position counters, and 4 eight-position counters.[69] This minute subdivision of counters is another major element of advanced engineering for a simple wiring arrangement permits the coupling of counters to make larger counters of whatever capacity required. A machine serial number, composed of letters and numbers, might require 17 adjacent positions when indicated on a report, and in an alphabetic machine this number could be printed from the coupling of 4 four-position counters and 1 two-position counter. In a numeric tabulator, counter capacity is limited to 9 positions in the standard machine, providing capacity for printing up to $9.999.999.99, which is far greater adding capacity than is required in the average case. The unfortunate limitation of numeric machines is that a nine-position counter cannot be used both to indicate and add at the same time. Furthermore, in a numeric machine, extra adding capacity can only be obtained by splitting counters, which induces the further limitation of insufficient carryover and interferes with direct subtraction. So the individually controlled counters of the alphabetic machine provide ideal counter flexibility for all combinations of work. Undoubtedly the day will sooner or later arrive when numeric accounting machines will be provided with individual balance counters.

The alphabetic machine is a more compact unit than the numeric, placing all controls within easy reach of the

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operator. Cards may be continuously fed into the alphabetic tabulator while the machine is in operation; a numeric machine must be stopped when cards are loaded. The alphabetic unit is equipped with an automatic plugboard which permits rapid changes. Any field of the tabulating card may be used to record either alphabetic or numeric data, so that gang punched fields, duplicated fields and key punched fields may be located for the greatest punching efficiency.

As previously mentioned, an alphabetic type bar can print any of 26 letters, 10 digits and one special character, - in other words the unique punching of holes in only one 12-position card column can control the automatic printing of any of 37 characters. This punching is demonstrated below:

Combined Digit	Zone 1	Zone 2	Zone 3	Zone 4
	Combine 12 Position	Combine 11 Position	Combine 0 Position	Single Punching
1	A	J	S	1
2	B	K	T	2
3	C	L	U	3
4	D	M	V	4
5	E	N	W	5
6	F	O	X	6
7	G	P	Y	7
8	H	Q	Z	8
9	I	R		9

Alphabetic characters are determined by double punching of the card column, and a 12th, 11th, or 0 position is perforated in combination with a digit from 1 to 9 to represent the recording of the 26 letters in direct progression. Numerals from 0 to 9 are signified in the tabulating card

by the standard punching of single holes. Punching of the 12th position only prints a special character.

As in all International accounting machines, the alphabetic tabulator has two sets of card reading brushes, - the upper or "control" brushes and the lower or "adding brushes". Sensing alphabetic data requires action of both the upper and lower brushes. The upper brushes first read the zone punching (12,11, or 0) and the lower brushes later read the lower hole of the punched column to determine the character to be printed.[70] An alphabetic type bar consists of two major parts, - the outside casing and the inside casing. The outside casing is arranged with 10 steps which correspond to digits of a card column.[71] The inside bar carries the 37 type characters and is located within the outer casing. The printing of the proper character is caused by zone wiring both the adding brush and control brush positions, thereby making the zoning latch magnet in the print unit operate from one of four zoning steps.[72] Zoning determines which character of a type bar is on the printing line and the lower brush reading determines which group is brought to the printing line.

16.0 Summary Punches

16.1 The International Automatic Duplicating Summary Punch

The manual punching of total cards from data appearing on tabulated reports used to be one of the time consuming routines of the punched card method. Such summary cards and new balance cards are used to reduce the volume of

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cards in the current file and to speed up the compilation of accounting and statistical analyses. The duplicating summary punch is constructed for the automatic preparation of total cards or new balance cards simultaneously with the tabulating operation. The arrangement consists of a motor drive duplicating key punch connected to the counter wheels of the accounting machine by a multiple wire cable. With the exception of the cable and a plugboard for flexible transmission from the counter wheels of the data to be punched, the punching unit is identical with a standard duplicator and may be used as such. The punch may be actuated by manual key depression, by master card operation from the duplicating rack, and by the counter wheels of the summary punch.

In the cycle of operation, the accounting machine tabulates until change in control occurs for which totals are to be punched. All positions to be summary punched from the tabulator must be taken from a counter wheel. The accounting machine will not clear and print until the summary card has been completed. The complete summary punching of 80 columns would require about 8 seconds, but practically, about 40 or so columns would be ample for recording the average case. Continuous feeding of the summary cards, continuous travel of the duplicating rack during the punching operation and automatic ejection from column 80 make it possible to operate the summary punch merely by feeding the tabulator and maintaining ample card supply in the summary punch stacker. The summary punching operation is not only valuable in labor

saving, but also in other aspects like simplification of report proof by obtaining control totals from summary cards, substitution of machine printed totals for adding fields instead of pencil totals written in by calculator proof, and removal of peaks of machine running time by replacing large volumes of detail cards with only a few machine summary cards during the report period. The continuous punching of the 80 column summary card is assured by automatically skipping unpunched fields by use of high skip bars.[73] Each adding counter of the tabulator is matched with an X punching control switch for that counter in the punch. A negative balance may be taken from the tabulating machine counter where it appears in complement, may be transferred into the summary card in direct figures of punching and may be punched automatically as a minus X. The delay necessary to allow for punching of summary cards when the tabulator is at a full stop naturally increases the reset time of the tabulator, which constitutes a real objection to the use of the duplicating summary punch.

16.2 <u>The International High Speed Gang Summary Punch</u>

The perfection of the high speed summary punch came about in 1937. It had always been recognized that the duplicating summary punch was an especially slow machine, since it required the pro-rata share of 8 seconds to punch the proportionate number of columns in the 80 column card. In the duplicating summary punch, only one card column punches at once, in step with the automatic horizontal spacing of the

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summary card, one column at a time. The high speed gang summary punch is five to six times as fast as the duplicating summary punch, and represents another milestone in machine progress, since faster work in the comparatively inexpensive operation of summary card punches, releases more running time of costly accounting tabulators. The high speed summary punch can also be used as an automatic gang summary punch. It cannot be used as a manual key punch like the duplicating key punch. The high speed punch is in reality a reproducing punch, cut vertically in two at the gang punch feed, which has been equipped with a flexible plugboard which ties together counter wheels of the tabulator and cutting positions of the summary punch through a cable. The plugboard of the summary punch may be used both for summary punch wiring and gang punch wiring. The machine may be used as an automatic standard gang punch, cutting 100 cards a minute. It requires only .8 of a second to summary punch a card in the high speed machine, whether 5 columns or 80 columns are cut, and this speed is so much faster than the 8 seconds required for duplicating 80 columns in the duplicating summary punch because holes are cut vertically instead of horizontally. All 12th positions are perforated at once in this machine, and so on through the other 11 punching positions, and the card travel through the machine is vertical with reference to the punch dies.[74] This confines hole punching in the high speed summary punch to timing in 12 card positions as compared with 80 possible positions in the duplicator. The

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high speed summary punch is completely flexible regarding localization of fields in the summary punched card, as any counter digit can be wired to summary punch in any of 80 columns. As in the duplicating summary punch a plus or a minus X may be automatically punched, simultaneously with cutting direct figures for adding fields in the summary card, when positive and negative balances are recorded from the tabulator.

17.0 The International Multiplying Key Punch

17.1 Function and Description

The multiplying key punch is a high speed, automatic machine which multiplies factors punched into tabulating cards, adjusts the products to the nearest whole number, punches the resulting products into cards, and accumulates the sum of the individual products in a visible products counter for control posting. The machine consists of a card reading unit; multiplying, transferring and storing counters; and a punching unit. The principle underlying the multiplication operation is extremely simple. As each card feeds into the machine, the multiplicand and multiplier are read from the card and are set up in the machine. The multiplication operation is then performed and the card feeds into punching position. The product of the multiplication is transmitted to the punching mechanism and is simultaneously registered in the summary products counter. While the card is being punched in the extension field and ejected, the reading operation is performed for the next card. The

machine is equipped with an automatic plugboard which makes it entirely flexible for the reading, multiplying and punching of data as desired.

17.2 Method of Computation

The operating principle of the machine is based on accumulation of partial products, instead of the more generally used principle of repeated addition common to manually operated equipment.[75]

The repeated addition method is based on the repeated adding of the multiplicand, the number of times it is added depending on the value of each digit of the multiplier. The series of repeated additions for each multiplier digit is completed in the adding mechanism one place removed to the left, as illustrated.

Example of Repeated Addition[76]

Manual Method	Repeat Addition Method
5948	5948
x1037	5948
41636	5948
17844	5948
5948	5948
6168076	5948
	5948
	5948
	5948
	5948
	5948
	6168076

In the partial products method, a partial product is the amount secured by the actual multiplication of the multiplicand by a single digit of the multiplier. Each

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partial product consists of a right-hand component (R.H.C.) and a left-hand component (L.H.C.). In the computation of 8x7, with a product of 56 the 6 is the R.H.C. and the 5 is the L.H.C. The R.H.C. counter is made up of the units-position digits of the successive products secured by multiplying the single digit of the multiplier by each digit of the multiplicand in turn. The L.H.C. is made up of the tens-positions digits of the same successive products. In accordance with the following illustration, 41636 (the partial product secured in multiplying 7 times 5948) is broken down into 5386 and 32650, right and left-hand components, respectively.

Refer to next page for illustration of operation in the multiplying punch.

Example of Multiplying Key Punch Operation[77]

```
   5948
  x1037
  41636     - Partial Product 1
 17844      - Partial Product 2
5948        - Partial Product 3
6168076
```

LEFT HAND COMPONENTS COUNTER (TENS)		RIGHT HAND COMPONENTS COUNTER (UNITS)
	5948 x1037	
50 2 6 3	56 28 63 35	6 8 3 5
36250	41636	5386
200 1 2 1	24 12 27 15	40 2 7 5
PROG. TOTAL 157450	17844	PROG. TOTAL 62626
	80 4 9 5	8000 4 9 5
TOTAL L.H.C. 157450	5948	PROG. TOTAL 6010626 TRANSFERRED
TOTAL R.H.C. 6010626 PRODUCT 6168076	6168076	

The center column shows how the components are formed. Actually, the complete LHC and RHC are calculated and added to respective counters in one machine cycle. As each successive digit is used in the product extension a shift one position to the left is made before components are added into their counters. Zeros in the multiplier

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cause the machine to shift over additional positions automatically. After partial products of each significant digit of the multiplier have been computed, a progressive total of all the R.H.C's and L.H.C.'s of all partial products will be standing in their respective counters. The complete product is formed automatically by transferring and adding the amount in the R.H.C. counter to the amount standing in the L.H.C. counter, one place to the right as a units balance is being footed with a tens balance.

17.3 Operating Features

The capacity of the machine permits computation of 8 digits times 8 digits, and a 10 digit summary products counter accumulates the significant digits to the left in the final answer.[78] An automatic .5 pick-up is automatically footed into each extension in the cents, mills, or tenth of mills position so that the ultimate product will be accurate to the nearest cent, mill, or tenth of mill as desired. The speed of the machine varies directly with the number of digits in the multiplier, from 1500 cards per hour for a 2 digit multiplier to 750 cards per hour for an 8 digit multiplier.[79] The practical speed, for 3 and 4 digit multipliers will have a range between 1300 and 1150 cards per hour, which is approximately 5 times as fast as the multiplying operation and recording can be performed by electric calculator.[80] The multiplier has the additional features that its extensions are always correct, that the

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punching of the extensions is an automatic by-product of the multiplying process, and that the visible products counter accumulates for control purposes the sum of the extensions of all the cards. The machine has a reversible switch for checking the multiplication by a secondary run of cards, if a comparative check is absolutely necessary. In the check operation the multiplicand and multiplier factors are reversed, signifying a totally different accumulation of factors to prove with the original total.

The machine is capable of individual extension in which the multiplier is punched in the detail card, or group extension in which the multiplier is obtained from a master rate card sorted ahead of the detail cards of like identity. Two factors may be multiplied by a third if the factors are small. Small factors may be cross-added or cross-subtracted to obtain computation and punching of a gross or a net result.

18.0 The Classification of Economic Activity into Major Groups

The discussion of individual units of tabulating machine equipment has been presented thus far from a descriptive and general functional point of view. Sufficient data have been provided to indicate the leading physical attributes of all units of tabulating machines and the manner in which they operate. Specific attention will now be devoted to the utility of these unique machines in actual cases which have been carefully selected from the entire field of

business activity. The subject matter for the various applications of the punched card method that will follow has been determined by the personal investigation of the writer in specific representative companies which use the tabulating system. The writer is indebted to both the International Business Machines Corporation and the Powers Accounting Machine Company for their splendid co-operation in arranging the interviews which have provided a wealth of pertinent and specific information in the different types of cases selected. Appreciation must also be expressed for the courteous permission granted by the different businesses in allowing an outsider to inspect the applications freely on their premises.

A comprehensive classification of the field of business is provided by "Moody's" in the subdivision provided in the manuals for investment purposes. These manuals separate business into five major divisions as follows: industrial corporations, public utilities, railroads, banks and insurance companies, and the field of government. It is the purpose of this study to demonstrate the use of the tabulating machine method in each of these broad fields. Banks will be considered as a separate division from insurance companies in this study, expanding "Moody's" break-down to six classes. The major emphasis in discussion will be given to the industrial field, from which several distinct applications have been chosen, and this emphasis is rightfully stressed because the tabulating machine method has been most widely applied in this group. The banking field is the least developed of the

six in punched card accounting, yet it is only within two years that the bank proof machine, to be described later, has received universal acceptance in the largest banks for rapid clearing of checks.

18.1 The Wide Range of Equipment Available

Prior to discussing specific application in the different fields of industry, special reference is made to the distinctive variety in types of machines available. Considerable previous discussion has been devoted to description of individual machine units. The particular kinds of equipment which are selected for a given job depend upon the specifications of the work to be done. In order to illustrate the latitude of choice, specification data sheets containing photographs have been provided in the appendix for most machine units manufactured by the International and Powers Companies. In addition to an extensive display of tabulating machine exhibits, the appendix also contains a folder illustrating the bank proof machine and wiring diagrams for the International numeric tabulator and the reproducer. A blank International Rental Contract has also been supplied in the appendix.

19.0 A Complete Laboratory Case in Industrial Application: Sales and Cost of Sales Analysis at the Burbank Company: Terre Haute, Indiana.[81]

19.1 Nature of the Business

The Burbank Company manufactures silk and knitted underwear, and foundation garments and distributes through its own sales force directly to the retail trade. It employs a traveling sales group of sixty men who solicit orders from department stores, men's furnishing stores, women's apparel shops, and infants and children's specialty shops. The company distributes nationally, with branch sales offices in nine principal cities, and warehouse shipping points at five strategic locations. The line of merchandise made represents garments composed of 2000 combinations of fabric, style, and color over an average size range of six groups. The company has three mills located at different points. All mill production is sent to Terre Haute to be inspected, finished, labeled, and boxed. The company operates its own paper box factory.

19.2 The Sales and Cost of Sales Accounting Problem

There are four basic needs for sales and cost of sales information in the Burbank Company.

(a) A monthly sales entry is needed in the general ledger to charge Accounts Receivable Customers with the value of sales and to distribute the Sales account to several classes of product in accordance with the following journal entries:

81 The Burbank case is based on the writer's own experience.

Dr.	Accounts Receivable Customers	- Total charge billing
Dr.	Cash	- Cash sales
Cr.	Sales	- Distributed by 18 classes
Dr.	Sales Returns	- Total value of returns
Cr.	Accounts Receivable Customers	- Merchandise credits
Cr.	Cash	- Refunds

(b) Whereas sales amount on invoices is derived by calculating the total quantity of each amount shipped times the list price in the billing department, the cost of sales at standard is also computed by multiplying the quantity shipped times unit cost per dozen. A distribution of cost of sales is obtained for the works ledger to correspond with the 18 garment class divisions of the sales account in the general ledger, according to the entry,

Dr.	Cost of Sales	)Standard cost of goods
Cr.	Finished Goods Inventory	)sold by 18 divisions

(c) Monthly analyses of sales in dollars and dozens, by 18 classes of goods are required by the sales manager. Sales reports are prepared for each salesman, each branch office, and for the company as a whole. It is from these reports, prepared monthly on a cumulative comparative basis, that the sales manager directs the selling personnel. They not only serve as a measuring stick of current performance by salesman and branch office but also provide the important classification of sales by lines sold which constitutes the vital merchandising problem. Whereas salesmen are on a compensa-

tion basis of salary plus travelling expenses, the reports provide the information for payment of commissions when salesmen exceed their quotas.

(d) Statistical information of various sorts is necessitated. A monthly analysis of sales is needed for the Census of Manufacturers at Washington, Annual tabulations of sales by customers and towns by classes of goods are wanted to post sales records in the home office and branch offices, as well as to assist the salesmen in their selling plans. Certain other statistical data is demanded, as will be later explained.

19.3 The Sources of Sales and Cost Information

Invoices billed to customers provide the information used by the tabulating department in its sales work. Copies of all customer billing are received daily in the tabulating department from home office and branch office billing locations. These invoices represent the accounts receivable debits or credits to customers' ledger cards. An invoice contains the customer's name and address, date, customer's order number, Burbank order number, terms, shipping instruction, and salesman. In the body of the bill the items shipped are listed by garment number. The quantities of each size are spread horizontally across the sheet and footed to a quantity total. This total, extended times the list price per dozen shown on the sheet, determines the sales extension of each item. Parcel post, insurance, and other charges are indicated on the bill following the last item extension. The individual

extensions are totalized on the bill in an aggregate footing representing the charge to accounts receivable. Whereas items of seconds are labelled on the invoice the billing department marks, on the tabulating copy only, those items which were delivered from bargain stock at close-out prices.

The cost data are obtained from inventory pricing schedules prepared by the cost department. Standard cost estimates are revised for the entire line every six months. During the fiscal period, interim changes in the standard cost are made whenever the variation in cost exceeds plus or minus one per cent. The cost data in the tabulating department are controlled from a card cost record which provides for all changes in cost over a ten year period. This unit cost is transferred to the tabulating detail card by prepunching the values from the high speed summary punch. The actual cost extension of each item is determined in the multiplying key punch which sets up the dozens multiplicand and the unit cost multiplier from the tabulating detail card.

19.4 Equipment

The following machines are utilized by the Burbank Company for analyzing sales and cost of sales. All machines are 80-column numeric equipment. Two duplicating key punches, without motor drive automatic insert and ejection features, are required for punching. One horizontal sorter is used. A multiplying key punch performs the costing of sales. A non-list three bank tabulator is required for proving purposes. A five bank printing tabulator, equipped with four special

direct subtraction counters, is employed for report preparation. A high speed summary punch permits the combined functions of setting up the prepunched costing section of the detail cards and the automatic punching of summary cards as reports are tabulated. The power provided for the tabulating machines is furnished by two five kilowatt motor generator sets which convert 244 volts alternating current to 115 volts direct current necessary for operating the machines.

19.5 Volume of Work

The Burbank Company averages about 250,000 invoices a year, of which about 6 percent are credit bills. The business is highly seasonal, inasmuch as 55 percent of all delivery is made in the last four months of the year. Tabulating card volume approximates 800,000 cards a year, and the monthly fluctuation in volume runs from a low point of 40,000 cards to a peak point of 85,000 cards. About 15 per cent of all orders are obtained in advance for delivery in the spring and fall seasons. The clerical personnel required for all tabulating and statistical work consists of a base force of seven girls and a department head. Nine months of the year this force is sufficient for all duties performed, but in the other three months two or three temporary workers are required.

19.6 Tabulating Card Forms

The tabulating card forms used by the Burbank Company consist of the following:

(a) Manila detail card - Exhibit 3

(b) Red striped manila credit card - Exhibit 4

(c) Solid green customer code card - Exhibit 5

(d) Green striped manila summary card - Exhibit 6

(e) Solid salmon master costing card - Exhibit 7

(f) Orange striped manila card - Exhibit 8

The following step by step description represents the content of the basic manila detail card form.

Columns 1-3 record the date of the invoice. The months from January through September are punched 1 to 9, respectively. October is punched 0; November, 11; and December, 12.

Column 4 signifies the billing office. Home office billing is punched as office 1 and branch office billing is office 2.

Column 5 is used to differentiate between classes of merchandise, whether firsts, seconds or bargain stock.

Columns 6 through 14 are perforated with dozens amount. Inasmuch as the quantity shipping unit in the Burbank Company is dozens, the total quantity for a particular bill is often a whole dozens and fractional 12ths amount. Whereas standard packing of goods varies between lines as 6/12, 3/12, or each, and whereas the size spread in an order may specify quantities that vary from multiples of standard packing, any combination of fractional 12ths may appear in the total quantity. Primarily because of the multiplying punch, part dozens are punched in decimal equivalent to four places, assuring that the cost extension will be accurate

Exhibit 3

SALES ANALYSIS — Detail Card

441/5612 7-9
41 00441 05612
12 95

MONTH | DAY | OFFICE CL. MOSE | DOZENS (WHOLE, DECIMAL) | SALES VALUE | ALPHABET CLASS | CUSTOMER | TOWN | STATE | SALESMAN | DIST. & AREA | GARMENT CLASS | GARMENT CLASS | MILL PC. | FABRIC | STYLE | COL. | UNIT COST 1 (JAN.-JUN.) | UNIT COST 2 (JUL.-DEC.) | MFG. COST EXTENSION

CUSTOMER SELECTION — MANUAL — DUPLICATED — PRE-PUNCHED — GANG — GANG — MULTIPLIER

THE BURBANK CO.

I.B.M. 518024 — D46-34 — LICENSED FOR USE UNDER PATENT 1,772,492

Exhibit 4

THE BURBANK CO.

ALPH. CLASS	CUST.	TOWN	STATE	SALESMAN	DIST. & AREA
48	0085	0062	14	104	106

X | A.C. | CUST. | TOWN | STATE | SALESMAN | D&A

I.B.M. 513388

Jordan Marsh Co.
Washington St.
Boston, Mass.

SALESMAN: MOORE

DEPT OR LINES SOLD:

DISTRICT: BOSTON

TERMS:

CUSTOMER CODE CARD

Exhibit 5

SALES ANALYSIS — Credit Detail Card

555/11½
51 00555 31120
~~5 93~~

MONTH | DAY | OFFICE CL. MOSE | DOZENS (WHOLE, DECIMAL) | SALES VALUE | ALPHABET CLASS | CUSTOMER | TOWN | STATE | SALESMAN | DIST. & AREA | GARMENT CLASS | GARMENT CLASS | MILL PC. | FABRIC | STYLE | COL. | UNIT COST 1 (JAN.-JUN.) | UNIT COST 2 (JUL.-DEC.) | MFG. COST EXTENSION

CUSTOMER SELECTION — MANUAL — DUPLICATED — PRE-PUNCHED — GANG — GANG — MULTIPLIER

THE BURBANK CO.

I.B.M. 518024 — D46-34 — LICENSED FOR USE UNDER PATENT 1,772,492

Exhibit 6

SALES ANALYSIS — Master Cost Card

MONTH | DAY | OFFICE CL. NUMBER | DOZENS (WHOLE, DECIMAL) | SALES VALUE | ALPHABET CLASS | CUSTOMER | TOWN | STATE | SALES-MAN | DIST. & AREA | GARMENT CLASS | GARMENT CLASS | MILL PC. | FABRIC | STYLE | COL. | UNIT COST 1 (JAN.-JUN.) | UNIT COST 2 (JUL.-DEC.) | MFG. COST EXTENSION

CUSTOMER SELECTION — MANUAL — DUPLICATED — PRE-PUNCHED — GANG — GANG — MULTIPLIER

THE BURBANK CO.

I.B.M. 518024 — 046-34 — LICENSED FOR USE UNDER PATENT 1,772,492

Exhibit 7

SALES ANALYSIS — Summary Card

MONTH | DAY | OFFICE CL. NUMBER | DOZENS (WHOLE, DECIMAL) | SALES VALUE | ALPHABET CLASS | CUSTOMER | TOWN | STATE | SALES-MAN | DIST. & AREA | GARMENT CLASS | GARMENT CLASS | MILL PC. | FABRIC | STYLE | COL. | UNIT COST 1 (JAN.-JUN.) | UNIT COST 2 (JUL.-DEC.) | MFG. COST EXTENSION

CUSTOMER SELECTION — MANUAL — DUPLICATED — PRE-PUNCHED — GANG — GANG — MULTIPLIER

THE BURBANK CO.

I.B.M. 518024 — 046-34 — LICENSED FOR USE UNDER PATENT 1,772,492

Exhibit 8

SALES ANALYSIS — Manually Coded Card

MONTH | DAY | OFFICE CL. NUMBER | DOZENS (WHOLE, DECIMAL) | SALES VALUE | ALPHABET CLASS | CUSTOMER | TOWN | STATE | SALES-MAN | DIST. & AREA | GARMENT CLASS | GARMENT CLASS | MILL PC. | FABRIC | STYLE | COL. | UNIT COST 1 (JAN.-JUN.) | UNIT COST 2 (JUL.-DEC.) | MFG. COST EXTENSION

CUSTOMER SELECTION — MANUAL — DUPLICATED — PRE-PUNCHED — GANG — GANG — MULTIPLIER

THE BURBANK CO.

I.B.M. 518024 — 046-34 — LICENSED FOR USE UNDER PATENT 1,772,492

to the penny. The dozens field contains nine places in order that the summary card may have sufficient capacity for punching large quantity amounts when running accumulative reports. The typical quantity amount recorded in a card will be under 20 dozen.

Columns 15-22 are punched with the sales amount, and the ordinary extension will be a value under $100.00. The sales field is sufficiently large to contain sizable amounts in summary cards. While it may appear that columns in the detail card are wasted because the average values are much smaller than the summary card capacity, zeros are automatically punched in columns 6-8, and 15-17 from the customer code card; this eliminates the necessity of manual punching of zeros and provides a use for card columns that would otherwise not be required.

Whereas most of the columns from 1-22 are manually punched, columns 23 through 41 are automatically duplicated from the customer code card. Column 23 is punched either an X or an O to signify, respectively, whether or not the customer ordinarily purchases more than $300 worth of goods a year. This enables the sorting out of sales cards for important customers in a one column operation.

Columns 24-25 are punched for alphabetical class, according as the first letters of the customer's last name fall into any of 100 divisions of the alphabet. This field is required in connection with the serial coding of customer number to permit sorting of numerically coded cards into

almost perfect alphabetical order.

Columns 26-29 represent the coding of customers in a four digit field. Code numbers are assigned in blocks of five, serially by state, providing for indefinite expansion. The Burbank Company has about 13,000 active customers.

Columns 30-33 contain the code numbers of towns. These numbers are assigned serially from 1 toward 9,999 in each state. To predetermine a town code number for every town in the United States, the original coding list was obtained by consolidating the towns shown in the Postal Guide with the list used by R.G. Dun, and a number was given to each different location.

Columns 34-35 distinguish between each of the 48 states.

Columns 36-38 identify the salesman. The first digit identifies each of the nine branch offices and the second and third digits classify the salesman number within the branch.

Columns 39-41 are used to code any of 147 trading areas in which the sale may fall.

Columns 42-43 for garment class are at present unused.

Columns 44-45 represent the classification of the item sold into any of 18 garment class subdivisions. These code numbers are so devised that sorting on column 44 only separates the sales into a comprehensive 10 class grouping which is used when preparing annual customer statistics

for posting to sales cards.

Column 46 is used to identify any of four manufacturing plants.

Column 47 represents the profit range which the individual item bears, whether A,B,C, or D mark-up as noted in the Burbank Company's price list. The management desires that its salesmen devote more attention to those divisions of the line which carry full profit, and together with the sales manager, are much interested to observe that a profit class distribution of sales results bear a normal relationship within the different brackets.

Columns 48-52 and 53-57 are a part of the prepunched section of the detail card, containing the fabric number and the style of the item sold. The individual items, together with their standard costs are visibly identified on the detail card by an addressograph impression appearing at the top of the card. The punched holes correspond to the coding of the addressograph impression. The company manufactures 2000 different combinations of fabric, style, and color.

Columns 59-60 at one time were used for punching of 60 colors, but the punched information was abandoned in the tabulating card.

Columns 60-63 and 69-72 are used for perforating the standard cost per dozen of the two fiscal periods January June, and July-December, respectively. Two fields are used for manufacturing cost to simplify the periodical replacement

of the prepunched item file.

Column 64 is employed for identifying any of 10 divisions which are required, in conjunction with garment class coding to classify sales for purposes of the government census report.

Columns 65 and 66 govern the prepunched coding of items into a broad 77 fabric division group which affords a more minute classification of sales than the 18 class breakdown which is used for accounting and sales management requirement.

Columns 67-68 are unused, and together with the first garment class field and the color field, designate the unused capacity in the card for future expansion.

Columns 73-80 are automatically cut with the manufacturing cost from the run of cards through the multiplying punch.

19.7 General Significance of the Card Form Design

It is at once obvious from the foregoing that the detail card is a storehouse of information. Following only one basic punched recording of all the significant data in the tabulating card, any type of sales and cost report may flexibly, automatically, economically, speedily, and accurately be prepared from the proven tabulating card. Of the 80 columns available, 74 are significantly used. It is outstanding in this tabulating card that all types of possible numeric machine punching are included. The only manual punching required out of 74 columns is 16 columns of the

first 22, plus the punching of garment class "00" for seconds and bargain stock in columns 44 and 45 and the cutting of a manually punched unit cost. Columns 23-41, signifying customer coded information common to all items of an invoice, are duplicated in the detail card from the duplicating rack of the punch. Columns 44 through 72 are prepunched or gang punched in the high speed summary punch and identify in the detail card a complete coded description of the item sold, together with its unit cost. Columns 73-80, punched from the multiplier, automatically are cut with the cost of sales. It follows that the Burbank Company makes the fullest use of the attendant economies of coding, punching, and verification that are associated with the use of prepunched codes.

19.8 Use of the Customer Code Card

The dual prepunched customer code card is an accurate basis of coding and classifying sales for salesman credit. Broadly speaking, general salesmen receive credit for all shipments made to customers within the geographical boundaries of their particular territories, regardless of whether they solicited the orders directly or whether the orders came by mail from the customers to the shipping point. The territories of division managers overlap those of general salesmen and in a few cases specialty salesmen cause duplicate coverage with general salesmen in their calls upon the trade in the specialty lines. There is never any conflict as to who should receive credit for sales made

to a particular customer, as each salesman is assigned a specific list of customers within his territory. All changes in territory are made by official notification from the sales manager's office to all departments concerned. The customer code card in the tabulating department governs the official classification of salesman credit for all sales made. This card shows the addressographed impression of the customer's name and address, the date the account was opened, the date of change in salesman, the name of the salesman, and the office in which he works. Across the top of the card appear the numeric codes for alphabet class, customer number, town number, state number, salesman number, and district and area number. The corresponding code numbers are punched into the respective coding columns.

The function of the customer code card is to punch automatically from the duplicating rack of the punch, those customer identifying fields which are used not only for the punching of all coding common to the items of any invoice but of all invoices billed to individual concerns. This automatic operation reduces the accurate classification of a sale to the correct pulling of a customer code card against the proper invoice and the subsequent use of the code card in the duplicating punch to record the transaction accurately. The physical operation consists of pulling the code cards from a file arranged alphabetically by customer, by town, by state and interspersing the cards, face up, between the corresponding invoices to which the

cards apply. The work is passed to the prepunched file for pulling of prepunched item detail cards. At least two customer code cards appear in the code card file for each customer and as many more cards are used up to about sixteen as are necessary in relation to customer sales activity. Customer code cards, following a checking operation after cards are punched, are released by a control clerk, machine sorted to filing order, and returned for filing back to be used again. The system is an entirely accurate and economical means of coding and punching.

19.9 Prepunched Item Cards

The description of the line number and the standard cost per dozen are prepunched in columns 46-72 by means of the high speed summary punch. Prepunched cards for each active fabric and style number in the current price list are filed behind index tab cards, standing on end in tub files. Each tub has ten compartments and is 30 inches deep and houses about 27,000 tabulating cards. The number of prepunched cards maintained in the file for each item depends upon the activity of the item. A minimum of 25 detail cards and 5 red-striped credit cards is set up for each item when costs are changed at the start of each fiscal period. The minimum is increased to adequate quantity and as many as 150 cards are prepared at one time for highly active numbers.

More important than the identity of the item number is the standard cost per dozen which is gang punched into detail cards. The positive correctness of replacement cards

in the tub files is controlled by a solid salmon master costing card. At the beginning of each fiscal period the new cost is cut into each master card, as well as during the period when the cost changes. The new standard cost is thoroughly checked in the new master card. All subsequent replacement cards for the fiscal period are made from the proven master costing card. On the reverse side of the master card the file clerk writes the number of replacements which she needs, so that the master card regulates the quantity of cards in the tubs as well as the accuracy of the information.

The replacement process consists of pulling the master card just before the supply of prepunched detail cards is exhausted. The file clerk orders the number desired by marking the back of the card. Blank manila cards are addressographed from the tabulating addressograph plate, and the operator stacks groups of master cards, interspersed with addressographed detail cards, ready for gang punching. The master card is punched X in the 11th position of column 73, but the detail cards are blank. This X position controls the automatic setup and clearing of each master card in its effect upon the detail cards which follow it when cards are continuously fed through the high speed summary punch. Cards may be duplicated at a speed of 100 cards a minute. The replacement cards are sighted with the master card which governs them to verify correctness and the

proven cards are filed behind the index tabs.

Two unit cost fields are provided in the prepunched card so that the complete changeover in the whole file will take place only once a year. The January-June cost is punched into unit cost field #1; the July-December cost in cost field #2. Toward the close of the fiscal periods, the stock of cards in tub files is allowed to run low so that as few cards as possible need be prepared with new cost data. The factors of card spoilage and the amount of labor involved to adjust the file are important. The cards left in tub files at the end of the first period are gang punched from the proven master cards set up for the second period.

19.10 Origin of Predetermined Sales Control

Both the tabulating and the accounts receivable departments receive independent copies of all company billing. The tabulating department immediately adds all invoices for sales total as soon as received. Home office and branch office amounts are entered on separate lines of the control slip. Credit invoices are also added for total. The control slip is sent to the accounts receivable department for verification with the results which it obtains when listing tapes for ledger controls. A copy of the accounts receivable tape is obtained from a carbonized roll, and this tape, together with the proven control sheet, is sent to the tabulating department. The proven footings of sales amount are posted daily to the predetermined tabulat-

ing control sheet, by billing offices, debits and credits separately. A daily tape is taken of parcel post, express, and handling charges, and is entered for each billing location to the accounts receivable tape. One parcel post card is punched daily for each control group for proof with the total of the parcel post listing, making it unnecessary to punch individual parcel post amounts appearing on each invoice.

19.11 Coding of Line Numbers

It has already been mentioned that garments are coded according to several classifications. The basic code for accounting purposes consists of an 18 group break-down. This code is a two digit code of which the first digit from 0 to 9, signifies a broad differentiation between types of garments made, according to age and sex. The second digit modifies specifically the particular major class. A further subdivision by 77 fabric divisions appears in the card for a refined grouping by all significant kinds of garments made. A five digit field is used for both fabric number and style. All numbers of new fabrics and styles are adopted in numeric nomenclature where possible. Letters in the fabric number, or letters and fractions in the style number are given a code number which bears definite relationship to the item coded.

19.12 Flow of Work through Preliminary Proving

Invoices are passed to the customer code card files

by control groups. The bills are sorted roughly to state order, and the clerk's knowledge of accounts permits the separation of large accounts in a special pile so that one card may be pulled for several invoices. A complete alphabetic sorting of invoices before pulling cards is wasteful of time and the partial sort works out satisfactorily. The code card clerk places the pulled card on top of the invoice to which it applies. If it is possible to group several invoices for the same customer, one code card may be used for the common bills. A rubber band is placed around the invoices of each control group. The groups of invoices at this point have been separated into sales territorial sections, home office and branch billing separately. The sections are passed to the tub file item division.

The prepunched file clerk pulls cards from the tub files in exact billing sequence. It is important to mention at this point that the pulled item card becomes the actual detail card which is later completed with all punched information for all fields. The speed of pulling cards is at a maximum rate of 400 cards per hour. Invoices which are incomplete because of the necessity of manually coding inactive items of bargain stock or because of the absence of cards in the file for new numbers added to the line are laid aside. Often these bills are delayed a few hours until exchange of mail brings cost figures from the cost department. Delayed bills are sometimes placed in folders stencilled "Rush" so that they will be given handling preference

to catch up with the original batch of bills which was routed incomplete. Prior to the punching operation, the pulled work of the prepunched file clerk is checked to ensure in all instances where two or more cards are needed for a bill that the cards are arranged in the same order as the billing sequence. When first pulled, the manila cards for each invoice are turned face down but after the checking operation, they are righted. The work is then handled by the punch operators.

The duplicating key punch with manual feed and ejection is used in punching. The work is so arranged for the punch operator as to allow maximum punching efficiency. The punch operator performs no checking, and assumes that the customer code cards and detail cards resting on top of each invoice are the right cards for the bill. The punch operator perforates the manual section of the detail card, punching in order month, day, billing office, class of merchandise, quantity, and sales amount. From the customer code card in the duplicating rack, the customer coding sections automatically picks up the punching of the detail card from columns 23 through 41. In the normal case the card is ejected from the machine, at this point by striking the release key. The customer code card is inserted in the duplicating rack with the right hand while the detail card is being inserted in the punch bed with the left hand. Both cards are inserted in the machine by sliding the racks

with the punch lever. A labelled panel marked by a pointer identifies the column number to be punched. The machine ejects the card one space each time a key is depressed.

Credit cards are physically distinguished from the debit manila cards by a half inch red striping on the manila surface at the top edge. The red striped manila cards are punched X in column 80 for sales returns. This X control position caused the amount, punched in direct figures and not in complement, to subtract when run through the tabulator. It usually happens that the punch operator will detect her own punching errors. In such instances she duplicates the correct portions of the spoiled card, makes corrections in the new card which she originates, and offsets the torn spoiled card in the position of the change, to be destroyed after the sighting of both cards in a checking operation determines that her work was correct. It should be noted that the use of the customer code card positively duplicates customer information common to all items of a bill, whether there are 2 or 50. The average number of items on an invoice varies from 2½ to 5, depending on the season of the year. The punch operator must complete manually coded orange striped cards by punching in the garment class and the unit cost. Manually coded cards are issued to code special numbers and alterations, as well as bargain inactive numbers.

The preliminary controlling operation is an important function. Whereas the tabulating department checks

to a predetermined sales total, in balance with accounts receivable, it establishes its own controls for dozens and cost of sales. The dozens control is determined by a double checking operation. The control clerk reads the customer information from the dual section of the code card and checks it with the customer and salesman billed. She then sights the code card with its detail cards to ensure that the code card was used with the proper detail cards. The order of cards is checked with the order of items on each invoice to ensure that this order is positively correct. Were this check not made, it would be possible for cards to have been shifted in the pulling or punching operation, causing the wrong dozens to be punched in the wrong unit cost card, which would invite grave error in the cost of sales. The control clerk then releases code cards for sorting and refiling, separates detail cards from invoices and groups the detail cards with rubber bands in convenient packs of about 40 cards each. By calculator she then adds the total sales amount, parcel post disregarded, and the total dozens, of the groups of invoices represented by the control packs of 40 cards each. She intersperses control packs between the groups of clipped invoices which they represent for the final checking clerk, whose duty it is to add the punched holes of the adding fields to prove whether the nonlist tabulator will produce the same counter totals as the amounts determined by footing her control

slips.

19.13 Final Checking

The justification for separating work into control groups of 40 cards each is to localize punching errors. Thus in a representative day's control section of 300 items about 8 control packs would be arranged for the final checker. The percentage of punching error of experienced punch clerks is much less than one per cent. The chances are that only one or two of the control packs will contain errors. The final checker may immediately spot the pack that is wrong, find the mistake by reading back the punched holes of the wrong field against the items of the corresponding bills, discover the wrong card, and return it to the punch operator for correction. When all control packs are correct they are run for one total, plus the parcel post card, to be checked against the predetermined sales total on the accounts receivable adding machine tape. The cards for the control section are then released to the multiplying punch for costing of sales. The control clerk runs the cards through the machine, which extends the cost, and punches the cost extension field at a rate of 1320 cards per hour. The control clerk posts the sum of all the cost extensions from the visible products counter to the attached control slip, which now contains the adding values of the control section for sales, dozens, and cost of sales. Once an hour the control clerk spot checks the accuracy of the multiplier

by running a test pack of 20 cards through the machine for proof with a predetermined total, in preference to running all the cards through the multiplier in a check operation. In the first six months of the year, cost of sales in the Burbank Company is obtained by plugging the dozens multiplicand in columns 7-14 and the cost multiplier in columns 60-63. The completely punched detail cards are now returned to the final checker who makes one run of all the cards of each section to prove from adding the punched holes the accuracy of sales, dozens, and cost. The proven totals are copied visually from the counters and posted to the proven tabulating control sheets, by billing section by sales territory, debits and credits separately. Parcel post is entered separately. The proven cards of each day are filed away by sales territory in fire proof vaults for accumulation until the end of the month.

19.14 Preferred Sequence of Finishing Work at the End of the Month

A normal lapse of two to four days separates the receipt of invoices and the proving of cards by the final checker. At the end of the month, work is scheduled through the department in preferred order of completing branch offices. The rushing of offices permits the preparation of final tabulations of the first two or three offices on the first working day of the report period. In other words, whereas all home office invoices for the 31st day of January would be received on February 1, finished reports would be

delivered for some offices on February 1. This preferential procedure permits completion of the work in stages so that the printing tabulator, the sorter, the nonlist tabulator, the multiplier, and the punches may all be kept busy progressively at the same time. The arrangement not only eliminates machine peaks but also results in speedy report delivery. In most months the sales manager will receive complete reports, consisting of 70 tabulations, the cost accountant will have obtained the cost of sales distribution, and the report proving clerk will have posted the sales entry to the general ledger trial balance within the first four working days.

19.15 The Cumulative Basis of the Sales Reports

The sales manager requires that all monthly sales tabulations for analyzing shipments should be prepared on a accumulative basis. Figures for the month only are not supplied to him, yet the proven tabulating department control is determined on control sheets for the current month. In order to suit the sales manager's requirement, a cumulative trial balance must be taken before reports are run. As each month's tabulations are made on a cumulative basis, summary cards are automatically punched. The summary cards of each salesman's tabulation for the first quarter would be grouped with April cards in order to produce a cumulative report for January through April 30.

It also happens that the sales manager requires sales figures to be submitted on a comparative basis, so that

he may compare shipments in dollars and dozens for the cumulative period this year with the same period of last year. This situation requires that summary cards of last year be grouped with summary cards of this year when preparing the comparative sales reports.

19.16 Preparation of the Cumulative Trial Balance

The final checker foots her control sheets at the end of the month for each branch office, totalling sales amount, dozens, and cost of sales amount, debits and credits separately. The following explanations will indicate the efficiency of the electric accounting machine and the summary punch and will demonstrate the practical use of the principles of class selection and direct subtraction.

Whereas the sales manager requires a comparative report of net sales in dollars and in dozens only, the accounting distributions require that gross sales in dollars, net sales in dozens, sales returns in dollars, and net cost of sales be supplied. Accordingly, one basic master report is prepared in running the cumulative trial balance by grouping cards of the current month with cumulative summary cards for the year to date, debits and credits separately, and summary cards for the year to date through the end of the current month are obtained. It is significant that from only one run of cards a summary card is prepared from which all subsequent distributions may be obtained. The final tabulations from the summary cards represent one set of reports for accounting purposes and another set of reports

for sales management purposes submitted on a comparative basis.

The cumulative trial balance of which a sample appears as report 1 in the appendix, is tabulated in the electric accounting machine as follows:

Counter 1	Counter 2	Counter 3	Counter 4	Counter 5
Man Garment	Net Sales	Net Sales	Credit Sales	Net Cost
No. Class	in Dollars	in Dozens	in Dollars	of Sales
36-38 44,45	15-22	6-14	15-22 and 46-53	73-80

The above grid indicates the kind of information which registers in each of the five counters. The figures below each counter space demonstrate from which card columns the data is obtained. The cards of office 1, cumulative and current, are sorted on column 80 to separate debits and credits. Each of the two groups is separately run in the trial balance. The separate groups are sorted on columns 45 and 44 to group the sales by garment class and on column 38 to segregate the cards of each salesman.

It will be noted in counters 2 and 4 that columns 15-22 provide the impulses for sales in dollars. Debit sales for both current month cards and cumulative cards are punched in 15-22 for sales amount and are No-X 80. Credit current month cards are punched in columns 15-22 but are punched X-80 to cause subtraction in counters 2 and 4. Cumulative credit cards are punched in columns 46-53, and are punched X-79 as well as X-80, to control direct subtraction in column 80.

The principle of field selection is illustrated in the computation of year to date sales in counter 4. A class selector is controlled by X-79. The subtraction impulse of columns 15-22 is obtained by linking the wiring of counter 2 with the No-X side of the class selector. The impulses of columns 15-22 from counter 2 will subtract only, because counter 4, the credit bank, is plugged only on the minus side from an X-distributor operated by X-80. The add impulses of columns 15-22 are eliminated by not plugging the plus side of counter 4. Columns 46-53 are plugged directly from the card positions to the X side of the class selector controlled by X-79. Both the No-X 79 impulses (which are X-80, columns 15-22) and the X-79 impulses (which are X-80, columns 46-53) are plugged to counter 4 from the common position of the class selector, thus causing subtraction impulses in the same counter from two different adding fields.

Why does X-79 have to be brought into the wiring circuit to aid X-80 in causing counter 4 to subtract credits? The cumulative credit cards of the previous month are added to the current month's credits before running the master report. It must be understood that the current month credit cards are punched in columns 46-53 with mill, profit class, fabric number, and the first digit of style, and unless there were some means of diverting this descriptive information it would also subtract on X-80 along with columns 46-53 of the cumulative credit summary cards. It will now be clear that

since a current month credit is No-X79 as well as X-80, the descriptive information will be eliminated in the class selector operated by X-79. The effect of the circuit is to cause cumulative credits through the previous month to add with the current months credits to compile cumulative credit totals for the year to date.

The direct subtraction circuit is illustrated by reference to the wiring of net sales in dozens in counter 2 from columns 15-22. Debit impulses come from columns 15-22, punched No-X 80 in both cumulative summary cards and monthly detail cards. Credit impulses are derived from columns 15-22, punched X-80 in both cumulative summary cards and monthly detail cards. Both the add and subtract impulses are brought into counter 2 by use of an X-Distributor actuated by X-80. The X-side of the Distributor, governing cards punched X-80, is wired to the minus side of counter 2, causing the creation of an automatic complement with each credit cycle, producing the effect of direct subtraction in the counter. The No-X side of the Distributor, influencing cards punched No-X 80 is tied to the plus side of counter 2. The common hub of the distributor is plugged to the counter control impulse. The adding brush positions, 15-22, are plugged directly to counter 2. Since both plus and minus amounts accumulate in the adding wheels of the counter in each control group, the result is a net total, printed directly whether the balance is a positive or a negative result. A credit total is indicated by the symbol "CR". The X-80 control position is

linked from X-Distributor 1 to X-Distributors 2,3, and 4, to govern the counter action of the other three adding fields.

The synchronizing of the summary punch with the electric accounting machine during the trial balance process deserves some consideration. A summary punch impulse must always come from an adding counter, never from a list bank. Figures appearing in the counter may be punched in any of 80 card columns. In this instance the same card positions are used to punch the summary cards which are employed in the original cards. The wiring is direct from the counter positions to the card columns, in the summary punch plugboard. It is possible to punch a plus or minus X in one card position from each of the four balance counters. In this instance it is desired to punch both X-79 and X-80 from counter 4, when running credit cards, for this total will always be a negative balance, should it contain any significant figures at all. The punching of two X's from the minus side of counter 4 is accomplished by using a split plug wire through the class selector in the punch plugboard. The reason for summary carding debits and credits separately will now be given. If both debits and credits are tabulated together, with four counters plugged for subtraction, the net sales might be a credit amount and the net cost a debit amount, making it necessary to punch a separate subtraction X from each of four balance counters. This is undesirable, for the summary cards should be punched in exact compliance with the wiring of the electric account-

ing machine so that the summary cards may be run through the tabulator both to prove their identity with the detail printed on the trial balance and to provide machine totals for the adding fields.

19.17 Proving the Trial Balance with Control

The electric accounting machine is wired through the automatic control unit to provide one summary card for each garment class of each salesman, debits and credits separately. All the salesmen of a branch office are run through the accounting machine and summary cards are prepared. The summary cards for the entire office are run through the tabulator with the minor control switch in off position. The resulting totals of net shipments in dollars, net shipments in dozens, sales returns in dollars, and net cost of sales are checked with cumulative control obtained by adding the totals of the current month's control sheet to the cumulative totals of the previous month. The two totals must balance. This cross reference of summary cards with trial balance cards is mutually beneficial, for the summary cards prove the trial balance, and the detail of the trial balance proves the summary cards.

19.18 Tabulation of the Accounting Report

From the proven summary cards of the cumulative trial balance the accounting report is prepared, purely for internal use in the tabulating department, aside from a total company summary which is sent to the management. Tabulations are prepared for each of the sixty salesmen. The summary

cards are resorted and tabulated in a summary report for each of nine branch offices. The summary cards are again sorted and a report is tabulated for the total company, by garment class. An illustration of the accounting report is found in the appendix, Report #2. Appreciation of the value of summary carding is gathered from the slight volume of summary cards required for the distribution. In the summary carding operation, monthly card volume of 80,000 detail cards is cut to about 1100 summary cards. It is emphasized that only one basic sorting of the 80,000 detail cards with only one detail card run for master report purposes produces the 1100 summary cards from which all actual reports are prepared by repeated use of the summary cards.

19.19 Preparation of the Comparative Sales Report

It was indicated previously that the cumulative comparative sales tabulation was obtained by grouping summary cards for last year to date with the cumulative summary cards of this year. An exhibit of the comparative sales report will be found in the appendix, report #3. The arrangement of information is as follows:

Counter 1		Counter 2	Counter 3	Counter 4	Counter 5
		Net Shipments in Dollars		Net Shipments in Dozens	
Man No.	Garment Class	This Year	Last Year	This Year	Last Year
36-38	44,45	15-22	15-22	6-14	6-14

It will be noticed from the counter arrangements that shipments in dollars for both years are punched in columns 15-22 and that shipments in dozens for both years

are punched in columns 6-14. Whereas the adding values for both years are punched in matched fields in the cumulative summary cards, it is necessary to class select last year's figures from this year's figures, since otherwise both years would add together. To identify last year's cards, X-22 and X-14 are gang punched into the summary cards. Physical differentiation between the two years is accomplished by using green striped summary cards every other year. The sales amounts for respective years are segregated in counters 2 and 3 by use of a class selector operated by X-22. Card impulses are led into the common hubs of the 10 position class selector from columns 15-22. The class selector actuation is obtained by wiring column 22 of the control brushes to the class selector control hub. The No-X 22 impulses which are this year's sales, are led from the top row of the class selector to counter 2; the X impulses, which are last year's sales, are wired from the middle row of the class selector to counter 3. Similarly, another class selector is used, operated by X-14, to separate this year's dozens and last year's dozens in counters 4 and 5.

The column headings for the respective counters signify that net figures are desired. The cumulative summary cards of both this year and last year consist of debit cards and credit cards, distinguished respectively by the lack of X punching or the X punching of columns 79 and 80. Counters 2, 3,4, and 5 must, therefore, be plugged for direct subtraction controlled by X-80. This is accomplished by use of 4 X-Dis-

tributors, linked for control by X-80. The X hub of Distributor 1 is wired to the minus side of counter 2, the No-X hub is plugged to the plus side of counter 2, and the common position is plugged to the counter control impulse. The wiring is similar from X-Distributors 2,3, and 4 to counters 3,4, and 5.

To facilitate reading of the tabulated figures and assimilation of the information, the hammers for cents are locked down when printing sales in dollars and the hammers for four place decimal dozens are locked down when registering sales in dozens. The effect of locking down the cents positions is very slight, since the addition of sales by classes to total is never more than $9.00 short of the total amount. The effect of locking down these hammers in the comparative sales tabulations is to report only the significant figures, making interpretation of the reports extremely simple. When tabulating the accounting reports, the hammers governing cents and part dozens must be allowed to register, since this particular report is employed to establish the accuracy with control. The comparative sales report by garment classes is prepared for all 60 salesmen, all 9 branch offices, and for the company as a whole. A copy of all reports is distributed to the sales manager. Each branch manager receives a copy of his office summary and the reports of his salesmen. Each salesman secures a copy of his own sales report. The originals remain the file copy of the tabulating department.

19.20 Proving and Release of Reports

The final checker is responsible for establishing that the totals of each office for the cumulative trial balance

agree with cumulative control. The totals for the cumulative trial balance are obtained by running the summary cards for total for each office, debits and credits separately. The cumulative control of the final checker is determined by adding the totals of the current month's control sheets, debits and credits separately, to the corresponding cumulative totals from the previous month's total. Any disparity between the two figures must be corrected by breaking up the erroneous work into control sections by days, with ultimate reference back to invoices. This type of checking back is not necessary more than once or twice a year, and then only in an isolated case. Such variations would be caused by misfiling cards of one office into another during the month. Tabulating cards are lost or mislaid but rarely, only once in five years, and even then, the absence of any missing cards may quickly be detected. Occasional off punching of holes causes a little difficulty, for sometimes the combination of a hole slightly off punching registration with the side-play of the card as it feeds past a particular adding brush will cause a wrong pick-up;this, however, happens very seldom. Now and then a punch operator may strike X-80 in a debit card or fail to punch X-80 in a credit card, but these errors are easily detected when running the trial balance. Once in a while a type bar will print one position off, causing an incorrect distribution between the sum of the detail impressions and the total of the group.

No reports are ever released from the tabulating department without having been proven. The duty of the report

clerk is to verify the tabulated report results against established control. Whereas the cumulative trial balance verifies the totals of debits and credits separately, she must establish that the computation of net results is correct, a calculator operation. She then adds each column of printed detail to prove that the sum of the detail agrees with the machine totals furnished by the summary cards.

The standard stationery used by the Burbank Company is 4 part continuous form paper, interleaved with one-time zip tab carbon. The sheets are perforated at the margin, for engagement by teeth set into the pin-feed platen to cause travel of the paper as the ratcheting device in the carriage causes platen rotation. The size of sheet is 9 5/8"x 11", and the paper has three double-spaced horizontal lines to an inch, which corresponds in alignment to standard typewriter spacing of six lines to an inch. The use of continuous form stationery in tabulating machines is general, inasmuch as considerable machine running time would be lost while stacking individual sheets with carbon for preparing multiple copies.

The report clerk mounts each four part setup of a salesman's tabulation on a bracket which has three pins at each side for engaging the holes of the paper. This mounting eliminates any slipping of the sheets as the clerk writes on the top surface, permitting perfect registration of the pencil impressions. The proving clerk writes with a hard pencil to guarantee a legible fourth copy. She fills in the report title, the salesman's name, the branch office and the column

headings of the information obtained from each machine counter. The date is stamped on each copy after the carbons have been removed. The reports are then distributed.

By way of summarizing the verification procedure, it is emphasized that the entire data, transcribed from the invoice in one basic preparation, is subject to a positive check. Control over the adding fields of sales, dozens, and cost is derived by adding the holes punched in tabulating cards against control totals either predetermined or established in the tabulating department. The cost of sales amount must be correct, for both the multiplicand and the multiplier are carefully proven factors, and the multiplying punch makes no errors except those caused by difficulties causing occasional mechanical service. The distribution of sales by salesman and customer is automatically controlled for accuracy by the customer code card. In other words, both the cost of sales amount and the sales distribution may be assumed to be correct because of the nature of the carefully checked and supervised procedure.

19.21 Summary Entries for Sales and Cost of Sales

The total company tabulation of the accounting report is used for preparing summary entries to the accounting records. Inasmuch as the figures on the tabulation are cumulative, it is necessary for the report clerk to deduct last month's cumulative totals from the current month's cumulative report in order to compute the current month's distribution. Gross shipments are obtained by adding the credit shipments

to the net shipments figures. The summary entry for charges is posted in the general ledger trial balance as a charge to Accounts Receivable-Customers and a credit to Sales, by classes of goods. Sales returns, by classes of goods are debited to Sales and credited to Accounts Receivable-Customers.

The cost of sales summary entry is posted net. The figures which are entered in the Works Ledger are weighted slightly in order to provide a Reserve for Inventory Variance. In the first six month's period, 3% is added to the standard cost of sales to determined the weighted summary entry; in the last fiscal period, 2% is added to the standard cost of sales. This arbitrary provision for inventory reserve prevents too extreme an undesirable adjustment at the end of the year. In a year when the business incurred a substantial operating loss, it would be extremely unwelcome knowledge to the management to discover that there was an additional severe inventory loss to sustain for which no other provision had been made. On the other hand, if the inventory adjustment were a favorable factor, a fair operating profit might become a large net profit when the inventory adjustment was made. The arrangement works out nicely. The actual entry for the cost of sales summary is a debit to Cost of Sales and a credit to Completed Product Inventory, by classes of goods.

19.22 <u>Monthly Tabulation of Net Shipments by Government Class</u>

The second monthly report obtained from the detail cards is a distribution of sales by classes of goods for the United States Government Census of Manufacturers. An out-

line of the form in which this report is tabulated is as follows:

Counter 1	Counter 2		Counter 3	Counter 4	Counter 5
Garment Class	Office	Govt Class	Net Shipments in Dozens Minor	Net Shipments in Dozens-Major	Net Shipments in Dollars Minor
44,45	4	64	6-14	6-14	15-22

An impression of the government report will be found in the appendix, report 4. Sorting for this tabulation involves handling the entire month's card volume. Since both total company deliveries and deliveries from branch office stock are required for this summary, the cards are sorted first on column four to separate home office shipments and branch shipments. The second column sorted is column 64, which arranges the cards in order by any of nine government classes. Sorting of the cards on columns 45 and 44 groups the card sequence in garment class order. The Burbank Company is required to report net shipments in dozens to the government on a classification of 14 divisions. In order to reconcile the government grouping with internal garment class control, the tabulation is made with billing office and government class on minor control and garment class on major control. The accuracy of the report is determined by checking out the government class groups of each garment class with the control established by the accounting report. A statistical summary is made by calculator from the tabulation, reclassifying the report information into government class grouping. The summary is released to the order and stock department which com-

pletes the report by making proper computations. The total dozens on hand at the beginning of the month, home office and branches separately, plus the quantity manufactured, less the deliveries to customers, equals the balance of stock on hand at the end of the month.

19.23 The Monthly Fabric Division Report

The third and final monthly tabulation is an analysis of sales by 77 fabric divisions, and is run according to the following counter arrangement:

Counter 1		Counter 2	Counter 3	Counter 4	Counter 5
Gar. Class	Fab. Div.	Net Shipments in Dollars	Net Shipments in Dozens	Credit Ship. in Dozens	Net Cost of Sales
44,45	65,66	15-22	6-14	6-14	73-80

This summary of sales by 77 divisions is illustrated in the appendix, report 5. As in the government report, this tabulation involves a run of the entire month's card volume. The cards are needled into garment class order from the government class report, and it is not necessary to sort by machine on columns 45 and 44. The report is prepared with both garment class and fabric division on minor control. Counters 2,3, and 5 all contain net figures and are, therefore, wired for direct subtraction. Counter 4 contains credit shipments in dozens, illustrating the class selection principle, obtained by wiring through an X-Distributor. The credit impulses transmitted from cards punched in columns 6-14, and cut X-80, cause direct subtraction in counter 3 and class selection in counter 4, another instance in which card positions in one adding field cause accumulation in more than

one counter. The tabulation of sales by 77 classes is used to assist in the planning and the checking of the production schedule.

It is noteworthy that the tabulating department in the Burbank Company is not concerned with size. 2000 items times an average run of 6 sizes would represent 12,000 units to be carried in the prepunched item files. Since cards would have to be added to the perpetual inventory file from shop orders as production was punched, and since the file would require some degree of denomination in order to apply sales quickly, the problems of filing capacity, volume of transactions, and cost of card preparation would create interesting questions for study under the tabulating method. Two later discussions of finished stock inventory control will indicate the principles of the application in different industries from the underwear business.

The monthly tabulation of sales by fabric division is summarized on a quarterly and on an annual basis from monthly summary cards. The quarterly tabulations, in particular, indicate the gross profit realized in the different divisions of the line. These reports are a basis for following the percentage of sales returns for the line sections. It sometimes becomes advisable to run special tabulations by item of particular groups of classes in which returns may run exceptionally high. The quarterly reports are useful in planning production.

A monthly report of sales by item is available from the tabulating cards at little cost, in accordance with

the following counter arrangement:

Counter 1	Counter 2	Counter 3	Counter 4	Counter 5
Gar. Fabric Class No.	Style Number	Net Shipments in Dollars	Net Shipments in Dozens	Net Cost of Sales
44,45x48-52	53-57	15-22	6-14	73-80

This report was formerly a regular monthly tabulation of the Burbank Company. It was abandoned because it duplicated information which was obtained weekly from the Kardex records in the order and stock department. It was felt that since the work of the planning department required information at more frequent intervals than a monthly period, and that since size information was not available from the tabulating work, much of the value of the fabric report was lost.

19.24 Other Optional Monthly Tabulations

Many other distributions are obtainable automatically from information stored in the tabulating card, and the nature of these reports is further evidence of the flexibility of the tabulating system. The three reports indicated were previously regular monthly tabulations, but although they were abandoned for various reasons they may still be obtained from the tabulating cards for the cost of the machine running of the job. The setting up of the information in the tabulating card costs next to nothing, for this information is all descriptive data which is obtained from either the master costing card or the customer code card. A mere mention of the kind of report is sufficient to cover its identity. First, a sales report is available by mill, by garment class, by profit class, showing net sales, net dozens, and net cost of sales. Second,

a tabulation may be prepared by salesman and profit class, showing net sales, net dozens, and net cost of sales. Third, a report may be tabulated by district, by trading area, by garment class, showing net sales and net dozens.

19.25 Summary Carding in Preparation for Annual Work

Annual tabulation of sales by customers by classes of goods is required for sales records. Inasmuch as this report necessitates an extensive sorting of many columns, it would be a great mistake to accumulate 850,000 tabulating cards representing a year's work and a severe machine peak without some preliminary simplification of the problem. In order that the customer tabulations may not conflict with other annual work of the tabulating department, they are prepared on the basis of a fiscal year running from December 1 through November 30. At the close of September work, summary cards are prepared from 10 months volume and about 700,000 tabulating detail cards are reduced to 45,000 summary cards. This means that the average customer purchases about four of the ten garment groups of the sales record classification, and that one summary card replaces every eighteen detail cards. Another factor in economy is the preparation of the summary cards from a partial sort of the indicating fields, whereas if the card volume were accumulated until the end of the year with no summary carding, all columns would have to be sorted for all detail cards. In addition to the detrimental factors of heavy machine running peaks and necessity of employee overtime, the ultimate delivery of finished tabulating reports

would be delayed much longer than desirable.

The necessity for summary carding 850,000 detail cards is emphasized by the sorting steps required for the final customer report. The following card columns must be sorted in sequence:

Columns 38-36	-	Salesman
Column 44	-	Garment Class
Columns 29-26	-	Customer Number
Columns 25-24	-	Alphabetic Class
Columns 33-30	-	Town Number
Columns 35-34	-	State Number

This means a 15 column sort of 850,000 cards, equivalent to a sort of 12,750,000 cards on one column. Since one sorter can sort about 24,000 cards per hour, 531 hours of continuous operation or over 13 weeks, would be required for the sorting job only. Under the summary carding plan in use at the Burbank Company, the final card volume handled in the 15 column sort is about 205,000 cards, made up of 45,000 summary cards for ten months, 85,000 cards for October, and 75,000 cards for November. The 700,000 detail cards for which 45,000 summary cards are produced are sorted only on 7 columns as follows: columns 38 and 36 for salesman, column 44 for garment class, and columns 29-26 for customer number. The alphabetic class, town number, and state number will appear at random in the tabulation when the master report is prepared. The breaking of the machine total for an individual summary card representing a particular customer is assured by plugging the automatic control unit of the tabulator for all 15 positions of the customer report. There can be no question that the

machine would fail to split between different customers for even though the alphabetic class, customer number, and town number would have a chance of being identical approaching infinity, the state number would have to be different as the same code number is never used twice for serially coding a customer number within a state. The sorting time for the summary carding is reduced from 13 weeks to less than 5, and is spread over the sorting machine in the months of September and October, which constitutes a feasible working plan.

19.26 Tabulation of the Annual Customer Sales Reports

An annual report of sales by customer by garment class is run for each of the 60 salesmen, in accordance with arrangement of data in the counters of the accounting machine as noted herewith:

Counter #1	Counter #2	Counter #3	Counter #4	Counter #5
Alph.Class Customer No.	Town State Garment Class	Net Shipments by Customer by Class-Minor	Net Shipments by Customer-Major	Net Cost of Sales by Customer-Minor
24-25X26-29	30-33X34-35 X44	15-22	15-22	73-80

As in all the report designs indicated so far, the figures on the bottom line under each counter heading represent the tabulating card columns from which the information is obtained. The symbol "X" between the card columns indicates the locking down of a type bar so that it will not register and will separate individual card fields by a space so that they may be read easily; without the intervening space, descriptive information would be jumbled together in one com-

posite code group which would be difficult to interpret. The actual form of the printed report is shown by report 6 in the appendix.

It has already been indicated that the sorting operation involves a 15 column operation with a volume of about 205,000 cards, representing a fiscal year period ending November 30.

Attention to important sorting details is essential in a voluminous sorting job over many columns. In the first place, taking the customer field in columns 26-29 as an example, the operator must always sort from right to left, or from the highest column number to the lowest number. This procedure eliminates the necessity of physically segregating a tremendous number of small units which with each column sort are broken into smaller units. By working from right to left all cards may be handled as one group, and when the sorting is completed the cards will be in perfect numerical sequence from customer 1 to customer 9,999. The groups of cards in the garment class sorted on column 44 are stacked in the order 5-4-2-7-1-9-8-3-6-0 instead of direct numerical sequence from 0 to 9. This is so, in order that the order of items as tabulated may follow, line for line, the same vertical arrangement that appears on the sales card. This matched order facilitates posting of the sales data to sales cards, with no confusion as to the space on the sales card in which a particular sales item should be posted. All pockets of the sorting machine have a capacity of about 600 cards.[81] Whenever a particular pocket fills with more than 600 cards, the machine stops automatical-

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ly, for if the sorting clerk failed to notice the overflow of the pocket otherwise, severe card jams would frequently take place when sorting. As the pockets fill up, the cards are transferred to a sorting rack with twelve compartments, corresponding in arrangement to sorting machine pockets, providing capacity for about 3600 cards in each section. Cards are stored in the sorting rack face down until the particular column being sorted is finished. The sorting brush is changed to the next column. Prior to feeding cards through the sorter on the new column, all cards should be turned face up in the sorting rack, or should be transferred face up to the glass platform of the machine. The order in which groups of cards go through the machine runs from 0 to 9, except for some special arrangement. The cards should be needled for sorting accuracy on the last column before proceeding to the next, which eliminates chiefly any physical errors in transferring sorted cards from the pockets to the compartments. Any occasional sorting errors made by the machine are also detected by needling.

The automatic control unit is wired for 16 positions, to cause automatic machine totals when any factor in the circuit changes. Either one field or several fields may change at the same time when causing the machine to take automatic totals. The total of each customer's sales by garment class is obtained by minor control in counter 3, matched with the tabulation of cost of sales in counter 5. Both sets of figures are net, requiring use of the direct subtraction

feature. Counter 4 is linked with counter 3 and clears only between customer changes. The customer total sales appearing in counter 4 will check to the penny with net charges to the customer ledger card in the accounts receivable department, except for parcel post amounts which are excluded from sales report control as a special distribution used directly by the accounting department to summarize the parcel post distribution. Of the four copies of the customer report available, the original which contains cost figures is retained in the tabulating department. The cost of sales is clipped from the other three copies which are delivered to the sales manager for home office use, the branch office for posting sales cards, and the salesman.

19.27 Decoding the Sales Tabulations

Numeric code numbers are used for coding customer data from the customer code card. Before a report can be released for general use outside the tabulating department it must be translated back to alphabetic indentification. The decoding of the numeric data is accomplished by mounting each four part section on the form bracket, with one time carbon still interspersed between sheets, and writing the alphabetic identification of the code numbers in a space provided for the purpose at the head of each account. A hard pencil must be used to accomplish good registration on the fourth sheet. Names are written on the report by good penmen for customer, town, and state. The town and state names are recorded on the report only as they change. To secure accuracy in identi-

fying the items, since these lists are the means of posting the sales records in the home office and branch offices, a check is made of the decoding accuracy. The customer reports are decoded from the customer tabulations of the previous year, with reference to a new account book which contains the names of customers added in the current year. The checking operation is performed by matching the decoding of each customer tabulation against the customer numbers appearing on cards in the sales file.

Summary cards for the entire year are punched simultaneously with the preparation of the annual customer report. These cards are available for a quick analysis of customer statistics during the year. The summary cards are used to provide two other geographical distributions of sales. Tabulations are run annually grouping the sales of each state by town, salesman, and garment class. Reports are also tabulated which classify sales by state, salesman, and garment class. These reports are decoded similarly to the customer sales reports and are also posted to the sales records in home office and branch office files.

19.28 Monthly Commission Statement by Salesmen

The tabulating department performs various statistical services from information obtained from the tabulated reports. Most of the foregoing has been devoted to a study of the preparation of the reports themselves. Brief consideration will now be given to some of the regular statistical work of the tabulating department. The first of these

duties is to provide the accounting department with each salesman's total business for the month. It was mentioned that most salesmen are remunerated on a basis of specified salary plus their traveling expenses, up to a point at which their accomplishment exceeds quota when they are paid additional commissions. It also happens that certain branch managers receive a specified salary plus a percentage of all the business realized by their particular offices, if quota is exceeded. A few salesmen are paid on a commission basis only at a flat rate on sales. The monthly, or annual, sales totals depending on the particular branch offices are adjusted by a deduction of 1.4% for sales discount to determine the figure on which sales commission is based. At the end of the year a further deduction is made from the commission base for bad debts written off against each salesman's territory. A commission payment is made to certain branch managers on a monthly basis, to other branch managers on an annual basis, and to all general salesmen on an annual basis, according as adjusted sales exceed quotas specified in contracts.

19.29 Monthly Rating Summary of Sales and Traveling Expense

The report clerk summarizes a comprehensive report of the month's sales and traveling expense for the sales manager. The branch offices as a group, and the salesmen as a group are given two definite monthly ratings based on the percentage of increase or decrease in sales against the same period last year and the percentage of increase or decrease in traveling expense against the corresponding period of last

year. The report of comparative standing, which also shows the change in rating from the previous month this year, is sent by the sales manager to branch offices monthly, along with letters of transmittal influenced by the rating report and the comparative sales summaries. The rating report provides a comprehensive picture of sales and expense results of the current month on a comparative basis and provides much significant information for the sales department with use of very few figures.

19.30 Monthly Comparative Selling Cost

A cumulative monthly analysis of selling cost, shown comparatively, is made by the statistical clerk, who obtains certain figures of the work from the tabulating department reports and other figures from the selling expense book and the general ledger trial balance. This report not only shows the direct selling cost of each branch office by main items but also distributes this cost between branch manager's selling expenses concerned with purely sales activities and office manager's expenses concerned shipping, billing, stenographic and other cost. The selling cost report also distributes to each branch office its share of home office expense for accounts such as advertising, fixed charges, general selling expense, sales discount, and actual bad debts. The total selling cost of all groups is footed for grand total, figured as percentage of sales, and compared by the amount of selling reserve setup by the estimates.

19.31 Monthly Statements of Gross Profit by Salesmen

The last monthly statistical tabulation compiled is an accumulative gross profit statement by salesmen. It consists of the amounts and the percentage of sales of the following data: net sales, net weighted cost of sales, gross profit, salesmen's salary and commission, and salesmen's expenses. The report is used by the management and the sales manager to gain information about the percentages of mark-up attained by each branch office and to follow closely the amount of direct sales expense of each salesman in relation to sales volume.

19.32 Sales Statistical Studies

Much could be written about the uses made of the sales statistics obtained from the tabulating reports, but such research and sales promotion activity is beyond the scope of the tabulating study under observation. The sales records are vital in reorganizing territories when changes are made in the personnel of selling personnel. The sales records are of value in determining potential markets. They assist the sales department in providing facts which are used in sales correspondence. They also have some bearing on the credit attitude maintained toward individual customers. They are of considerable value in revealing the efficiency of geographical distribution. The studies are also significant in emphasizing the distribution of divisions of the line. The main realization is this. Tabulating equipment used in a comprehensive sales and cost of sales application furnishes the sales statistics as an automatic by-product of the more important functional

features of the installation. It is possible, for instance, since the tabulating department furnishes gross profit by customer to estimate net profit or loss by customer by charging the customer on a careful basis with proper amounts of selling and administrative expense. It is generally figured in the Burbank Company that an account outside of the large metropolitan centers which receives the normal number of personal selling calls throughout the year does not begin to show profit until a volume of $200 has been secured. Specific information is readily obtainable from the tabulating cards or finished reports which would in some instances bear a prohibitive cost under a manual method.

19.33 The Cost of the Tabulating System

The most important measure of any business method is its cost not only in relation to the work accomplished but also in comparison with other means of performing the same function. Business is continually seeking the most economical means of accomplishing specific tasks, with important emphasis upon satisfaction with the results obtained. The annual cost of the tabulating system of the Burbank Company for sales and cost of sales analysis is as follows:

Machine Rentals	$5300
Tabulating Cards and Expenses	1400
Salaries - 8 People[82]	11000
Total Annual Cost	$17,700

19.34 Summary

To what extent is the annual expenditure of $17,700

82 Monthly Departmental Expense Sheets-Burbank Co.

by the Burbank Company for a tabulating system justified? The answer is to be found chiefly in the volume of transactions, the complexity of the business, and the kind and amount of information required by the management. It may be immediately stated that the results accomplished by this particular application at a cost of nearly $18,000 a year could not be even approached by any other known method. Other means of performing a part of the work accomplished by tabulating machines could be found, but the results would be unsatisfactory. The amount and variety of information provided by a manual method would be limited. The number of distributions would be narrowed to a few, thus solving the problem of providing information by eliminating the problem itself. The worst feature of a system based on manual calculating machines is its inflexibility. Inasmuch as such a method would involve the repeated handling of 250,000 invoices for each distribution taken therefrom, requiring laborious manual sorting of a large volume of invoices, information could be supplied only on a simple and modified basis. Comprehensive columnar work sheets would be needed, with much calculator work for cross footing and balance forwarding. An elaborate filing system would have to be maintained to contain the bills. Invoices would be sorted and filed incorrectly, work would be slow, no two distributions would check to a common control, and reports would always be late. Compare such procedure with the tabulating method which permits closing of sales and cost distributions within the first four working days.

In the Burbank Company, customer tabulations based upon a volume of 850,000 tabulating cards for the fiscal year ending November 30, 1937 were released to all 60 salesmen by December 31, 1937 and every report agreed to the penny with the basic control figures in the general ledger. The superiority of the punched card method in the Burbank Company is obvious. Concerning future expansion, any change in the manual method would be a major change, probably requiring more personnel and more equipment, adding to inflexibility already existent. On the tabulating basis, the larger the volume and the more complex the system, the more the advantages of the punched card plan become apparent and the greater the amount saved. In the Burbank Company, the electric accounting machine is used only 70 percent capacity with no overtime operation. The multiplying punch is used only 45 percent capacity. The Burbank Company could endure a 50 percent increase in volume of work with no equipment change other than an additional key punch; on this basis one more punch operator would be needed and one general clerk. In other words, 50 percent more work would require an added cost of less than $2,500 a year. An interesting case of actual comparison was recently developed in the Edison Electric Illuminating Company of Boston. In 1936 this concern spent more than $35000 for new posting equipment of a well known make to be used for accounts receivable billing.[83] By the summer of 1937, this new equipment, of the latest design in 1936, was rendered obsolete while still hardly

83 Conference with E. Betz, I.B.M. salesman

depreciated, by a tabulating system which performed the function at a substantial annual saving, on a more efficient basis and with a smaller clerical force. On the manual basis, the actuating stroke compelling a character registration on an invoice was the touch of a human finger; on the punched card basis, the accounting machine does most of the work automatically. A large alphabetic tabulator with list speed of 100 cards a minute can prepare in about a minute a lengthy invoice that might require half an hour in a manually operated billing machine.

20.0 Accounts Receivable at The Halliday Company, Evanston, Illinois

20.1 The Nature of the Business

The Halliday Company is a leading manufacturer of floor covering, roofing material, and corrugated boxes, selling some lines of merchandise direct to dealers through company salesmen, and other lines of goods to wholesale jobbers on a contract basis. The company has three manufacturing plants in the United States and one in Canada. The annual volume of business exceeds $30,000,000. The company has 12,000 active customers, of which 7,000 accounts have open balances on the company's books at the end of each month. The company issues approximately 415,000 invoices a year. The average age of accounts receivable is 45 days. The number of open items on the books at the end of the month averages 5. The percentage of credit invoices is 7% of the total billing. Customers are divided in almost equal numbers among the three divisions of floor covering, roofing products, and corrugated boxes. The accounts receivable for each division are operated separately. Each of the three sections is broken down into 16 ledgers, which in some cases represent subdivisions of 8 branch offices, and about 500 accounts are kept in each ledger. Terms of sale vary according to the type of dealer who purchases and in relationship to the article ordered. Deliveries are made from the home office plant in Evanston, from all factories, and from branch warehousing points. Copies of all customer billing are sent to the home office Accounts Receivable Department. All bills are due on

the tenth of the month, on an end of the month basis dating from the 25th of the second month previous through the 24th of the previous month for taking discount. For sake of illustration, 2% end of the month, net 60 days terms will be used in this discussion. 85 per cent of all customers take discount in making remittances. About 10 per cent of all cash is received in the first 10 days of the month, 80 per cent in the middle 10 days, and 10 per cent in the last 10 days. A few customers purchase from more than one of these three major divisions of the company, and usually make separate remittances for amounts purchased from each division. Nearly all customers make use of remittance statements when sending payments.

20.2 <u>The Accounts Receivable Card Forms.</u>

The different card forms used in the accounts receivable work are indicated as follows:

Exhibit 9 - Manila sales form.

Exhibit 10 - Ivory accounts receivable card - floor covering.

Exhibit 11 - Ivory index tab card.

Exhibit 12 - Orange striped accounts receivable card - roofing.

Exhibit 13 - Green striped accounts receivable card - boxes.

Exhibit 14 - Red striped index tab card for low limit and delinquent accounts.

The sales card does not require detailed comment, other than to note that a separate card is punched for every item

Exhibit 9 SALES Detail Card

EAST WALPOLE MASS. AND CHICAGO ILL.

THE HALLIDAY CO.

BILLING DAY | SHIPPING DATE MO. DAY | ORDER NO. | PRO. NO. | DIV. LED. | STATE | CUSTOMER | DEA LER | SALES-MAN | DIS-TRICT | ACCT. | WHSE. | STATE | COUNTY | TOWN | PRODUCT | COLOR | GROUP | CONVERSION | QUANTITY | SALES VALUE | FREIGHT | CF

PRODUCT | SIZE | PATTERN | QUANTITY | SALES VALUE | ROLLS | CF

SALES-MAN | DIS-TRICT | ACCT. | WHSE. | SIZE | WEIGHT | KIND | BOX | LID | IM-PRINT | SPECIAL | CUSTOMER SHIPPED | QUANTITY | SALES VALUE | BUNDLES | CF

SALES-MAN | DIS-TRICT | ACCT. | WHSE. | SIZE | SQ. FEET | KIND | CALI-PER | WEIGHT | CUSTOMER SHIPPED | QUANTITY | SALES VALUE | BUNDLES | CF

IBM 525343

LICENSED FOR USE UNDER PATENT 1,772,497

Exhibit 10 Floor Covering

THE HALLIDAY CO.

CUSTOMER NO (CR) | NAME | J F M A M J J A S O N D

	DATE PAID
	BANK NO
	NET CASH
	CASH DISCOUNT
	FREIGHT
	ACCOUNT
	AMOUNT
	ACCOUNTS RECEIVABLE

OTHER

REMARKS

CR CL | CREDIT MO DAY YR | BANK NO | NET CASH | DISCOUNT INTEREST | OTHERS ACCT AMOUNT | ENTRY DAY | DR CL | DEBIT MO DAY | ORDER NO | PRO. NO | DIV. LED. | STATE | CUSTOMER | ACCTS REC NOTES REC | FREIGHT

IBM 523794

LICENSED FOR USE UNDER PATENT 1,772,497

ACCOUNTS RECEIVABLE

Exhibit 11

THE HALLIDAY CO.

NAME

DIVISION

DATE ACCOUNT OPENED

DATE CARD TYPED

CREDIT LIMIT

TERMS

Index Tab Card

CREDIT LIMIT	DIVISION	Division Ledger State	Customer
0 0 0 0 0		0 0 0	0 0 0 0 0
1 1 1 1 1	LEDGER	1 1 1	1 1 1 1 1
2 2 2 2 2		2 2 2	2 2 2 2 2
3 3 3 3 3		3 3 3	3 3 3 3 3
4 4 4 4 4	STATE	4 4 4	4 4 4 4 4
5 5 5 5 5		5 5 5	5 5 5 5 5
6 6 6 6 6		6 6 6	6 6 6 6 6
7 7 7 7 7	CUSTOMER	7 7 7	7 7 7 7 7
8 8 8 8 8		8 8 8	8 8 8 8 8
9 9 9 9 9		9 9 9	9 9 9 9 9

ACCOUNTS RECEIVABLE INDEX CARD

Exhibit 12

Roofing

ACCOUNTS RECEIVABLE

CUSTOMER NO (CR) | NAME | J F M A M J J A S O N D

DATE PAID | BANK NO. | NET CASH | CASH DISCOUNT | FREIGHT | ACCOUNT | AMOUNT | ACCOUNTS RECEIVABLE (OTHER)

REMARKS

CR. CL. | CREDIT MO DAY YR | BANK NO. | NET CASH | DISCOUNT INTEREST | OTHERS ACCT. AMOUNT | ENTRY NO DAY | DR CL. | DEBIT MO DAY YR | ORDER NO | PRO. NO. | DIV. LED. | STATE | CUSTOMER | ACCTS. REC NOTES REC | FREIGHT

THE HALLIDAY CO.

LICENSED FOR USE UNDER PATENT 1,777,492 I.B.M. 503794

Exhibit 13

Corrugated Boxes

ACCOUNTS RECEIVABLE

CUSTOMER NO (CR) | NAME | J F M A M J J A S O N D

DATE PAID | BANK NO. | NET CASH | CASH DISCOUNT | FREIGHT | ACCOUNT | AMOUNT | ACCOUNTS RECEIVABLE (OTHER)

REMARKS

CR. CL. | CREDIT MO DAY YR | BANK NO. | NET CASH | DISCOUNT INTEREST | OTHERS ACCT. AMOUNT | ENTRY NO DAY | DR CL. | DEBIT MO DAY YR | ORDER NO | PRO. NO. | DIV. LED. | STATE | CUSTOMER | ACCTS. REC NOTES REC | FREIGHT

THE HALLIDAY CO.

LICENSED FOR USE UNDER PATENT 1,777,492 I.B.M. 503794

Exhibit 14

Low Credit and Delinquency

THE HALLIDAY CO.

NAME

CREDIT LIMIT

TERMS

DIVISION

DATE ACCOUNT OPENED

DATE CARD TYPED

CREDIT LIMIT	DIVISION	Division	Ledger	State	Customer
0000		0	0	00	000 00
1111	LEDGER	1	1	11	111 11
2222		2	2	22	222 22
3333		3	3	33	333 33
4444	STATE	4	4	44	444 44
5555		5	5	55	555 55
6666		6	6	66	666 66
7777	CUSTOMER	7	7	77	777 77
8888		8	8	88	888 88
9999		9	9	99	999 99

ACCOUNTS RECEIVABLE INDEX CARD

of an invoice and that certain columns of the sales card correspond to identical columns in the accounts receivable card. This is necessary in order that the same customer credited or debited with sales or merchandise returns in the sales card may be charged or credited with amounts owed or allowed on the accounts receivable card. The corresponding of certain fields in the two distinct cards is necessary because the accounts receivable card is prepared by summary punching, simultaneously with verification of the punching of sales card. The columns which are identical are as follows:

Sales Card	Card Field	Accounts Rec.Card
7-11	Order Number	51-55
12-15	Pro Number	56-59
16	Division Number	60
17	Ledger Number	61
18-19	State Number	62-63
20-24	Customer Number	64-68
63-69	Sales and Accts. Rec. Value	69-75
70-73	Freight Paid on Sales	76-80

It will be noticed at once that the card columns are not identically located, illustrating the flexible punching feature which permits recording of information from any counter position in any column of the tabulating card. It will also be noted that the difference between items affecting the three major product divisions of floor covering, roofing material and corrugated boxes is indicated by separate color combinations to guide the filing of correct charges in the proper open file.

There are many bases for operating accounts receivable with tabulating cards, but the one most commonly found in use is the pulled card plan. The punched card accounts

receivable ledger is originated by setting up a tabulating card identifying each open charge or credit transcribed for each customer from a trial balance. Customers are assigned numerical code numbers which permit automatic sorting of the customers in each of eight branch offices into perfect alphabetical order by district; the districts in turn are broken down by ledgers as necessary to provide control groups of not more than 600 accounts in a ledger. Open charges and credits are filed behind the customer index card from oldest to most recent charge or credit date of transaction. Punched cards from current billing are filed into the open file daily at the end of each customer group. As checks are received, mostly during the discount period, the cash is applied by pulling from the open file those items which correspond to the amount credited to accounts receivable. The check of the cards pulled against the cash applied is governed by the preparation of a daily cash sheet, which not only proves the accuracy of cards pulled, but provides as well the cash and expense distribution and the bank deposit slip. Postings are maintained daily to a control sheet designed for each ledger. Twice a month trial balances are run in the accounting machine and reconciled with the control sheets. The pulled cards of the open file which have been proven after having been punched with cash reconciliation and tabulated for daily cash proof, are filed daily in a paid or history file, where they accumulate as a permanent record of the company's charge and payment experience with each customer.

The accounts receivable card, Exhibit 10, will now

be examined. A dual section of the card appears at the extreme left, occupying the space of columns 1-15, and this section is reserved for pencil posting of the cash application. The sections, in order vertically, represent payment date, bank number, net cash received, sales discount allowed, freight and express allowed, other allowances such as interest anticipation, and accounts receivable credit. The sum of the cash, discount, freight, and other allowance items equals the accounts receivable amounts which is balanced by the payment distribution. The information written in the spaces during the cash application is perforated in the proper card fields in the following columns:

Columns 11-15 - Payment date
Columns 16-20 - Bank Number
Columns 21-27 - Net Cash
Columns 28-32 - Sales Discount
Columns 33-35 - Other Account
Columns 36-40 - Miscellaneous Allowances and Interest
Columns 69-75 - Accounts and Notes Receivable
Columns 76-80 - Freight and Express Allowed

It is noted especially that accounts receivable amount is not punched in the accounts receivable field when applying cash, except in cases of adjustment to represent partial payments and over-payments, as will be explained later.

Columns 9-10 and 44-45 are used respectively to code the kind of debit or credit transaction.

Columns 46-50 are duplicated from the master rack of the summary punch to record debit date in the charge cards. Columns 11-15, date paid, are used to record merchandise credits.

The fields from column 51 through 68 are summary

punched identification fields which are obtained from the original coding of the sales card. These fields represent order number, pro number, division, ledger state and customer.

20.3 The Index Tab Card

The ivory index tab card, exhibit 11, serves several distinct purposes. The card is a dual record, showing in printed form all of the descriptive data which is punched into card columns. The customer code number appears both on face of the card and the lip tab at the upper left corner. This code number is written legibly in heavy black ink and identifies the filing position of the account in the ledger. Accounts are coded in a block serial code with unlimited expansion, in which the alphabet is broken into 1000 divisions by the first three digits of a five digit code. The last two numbers provide possibility for coding 100 customers within each group of alphabetic classifications. Customer name and address is addressographed in the space provided. The terms of purchase for each customer are indicated and the amount of credit limit to determine the high credit. Credit limit, division, ledger, state, and customer show on the card both in printed registration and punched hole recording. The index tab card is a regulation size tabulating card which passes through the machines with other standard cards, regardless of the lip. The index card is run with the detail cards whenever a detailed trial balance is taken. This card indicates the credit limit on the report ahead of each customer and may

be used as well for showing credit ratings in order to provide the Credit Department with full information for passing orders. Certain accounts whose credit is poor because of unfavorable ratings, low credit or slow payment are especially labeled with red lips on the tab cards. Weekly or daily statements, depending on the size of these accounts, are prepared for the Credit Department so that they may have full information for passing orders in these risky cases.

20.4 Transaction Codes

It is important that each debit or credit card be properly labeled with an identification of its classification. Inasmuch as orders are passed in the punched card system by reference to the semimonthly accounts receivable trial balance, supplemented by special statements of customer balances as necessary, it is vital for correct interpretation of the facts that the proper transaction be known. The following transaction coding is used at the Halliday Company.

Transacting Coding

Transaction Dr.	Transaction Cr.
11 Invoice	31 Remittance
12 CashDiscount Deduction	32 Cash Discount Allowed
13 Merchandise Deduction	33 Merchandise Credit
14 Freight & Express Deduction	34 Freight & Express Allowed
15 Journal Entry	35 Jounal Entry
16 Protested Check	36 Overpayment
17 Advertising Deduction	37 Partial Payment
18 Cash or C.O.D.	38 Interest Anticipation
19 Miscellaneous Debit	39 Miscellaneous Credit
20 Notes Receivable Deduction	41 Cash Item
	42 Bad Debts Written Off
	43 Commission-Office Selling Exp.
	44 Notes Receivable Collected

The above transaction schedule is sufficiently complete to provide for classification of all ordinary accounts receivable activity in the Halliday Company. The most common transaction numbers used are 11, representing a charge item from an invoice, and 31, representing the crediting of accounts receivable by remittance. Other debit transaction codes used frequently are discount, merchandise, and freight deductions. Other credit transaction codes used often are discount allowances, merchandise credits, partial payments, and overpayments.

20.5 Punching and Verification of Sales and Accounts Receivable Cards.

Customer invoices are received daily in the Tabulating Department from all billing offices of the company. The invoices are routed through the Order Department where they are coded for division, ledger, state, and customer number. The sales cards are completely punched. In order to prove the sales amount punched into the sales cards, a master report is run from groups of cards from a particular ledger section, grouping enough invoices to represent about 80 sales cards. The proving of each control group of each ledger section is obtained by the punching of accounts receivable summary cards as the master report is prepared. The customer identification in the accounts receivable card is controlled by double checking of the sales card in the verifying punch. To prove that accounts receivable total amount agrees with sales total amount, the accounts receivable cards are tabulated to prove the accuracy of the sales cards by checking the

total from the accounts receivable summary cards with the predetermined control obtained by calculator addition of the bills. In order to distinguish the accounts receivable summary cards when they are tabulated with sales cards for parallel balance as necessary,accounts receivable cards are punched X-70, and sales cards are No..X 70. A simple process of class section diverts sales and accounts receivable amounts to separate counters; the totals must agree. The charge date and debit transaction code are duplicated into the accounts receivable card from a prepunched card. When punching invoices for merchandise credits, column 69 is X-punched in the accounts receivable field. It is important to note at this point that X-69 always differentiates between a debit and a credit transaction in the open accounts receivable file. When punching merchandise credits, the date paid and the credit transaction fields are punched from a prepunched card in the duplicating rack.

As soon as the sales and accounts receivable cards for each control group of each ledger section for a billing day has been proven, the cards of each ledger are sorted by customer, and a trial balance is taken by listing the sales register from the accounts receivable cards. The total obtained from the accounts receivable and freight fields must agree with the predetermined sales control established from company billing. When listing tabulating cards, a total of the amounts listed may be automatically obtained for the entire group in a one reset cycle after the last card has

passed through the tabulator. The counter arrangement for sales register is as follows:

Counter 1	Counter 2	Counter 3	Counter 4	Counter 5
Ledger	State	Date	Accounts	Freight
Customer	Pro Number	Mo. Day Yr.	Receivable	
60-61x64-68	62-63x56-59	46-47x48-49x50 11-12x13-14x15	69-75	76-80

An example of the daily sales register will be found in the appendix, report 7. It will be observed that the impulses in Counter 3 for date are obtained from two different card fields to consolidate in one printing bank the debit or credit date as necessary. Credit amounts in the accounts receivable field are printed with the symbol "C R" beside the cents position. Debit and credit cards of each ledger section are tabulated separately. The debits are not punched X-69, but the credits are always punched X-69. It is the absence or presence of this X in the cards of the open file which determines whether the cards will add to, or subtract from, the customer's net balance when the accounts receivable trial balance is taken.

20.6 Posting the Accounts Receivable Control Sheet.

The totals for debit and credit billing for each ledger obtained from the daily sales register are posted daily to the accounts receivable control sheet. A separate sheet is maintained for each ledger in the three separate product divisions. The charge side of the control sheet contains three columns, for entering totals of home office billing, branch billing, and cash debits. Freight prepaid is added to the accounts receivable charge. The credit side of the control sheet

has two columns, for posting merchandise credits and cash credits. Home office and branch billing amounts are posted from the sales register. Cash credits arise from such items as protested checks and cash refunds. Merchandise credits are posted from credit invoices issued only by the home office. Cash credits are posted from the daily summary entry of the cash receipts book. The five columns are footed twice a month to obtain the control basis for proving the accounts receivable trial balance. The footings are made on the 15th and the end of the month, but the footings on the 15th are entered lightly in pencil at the end of the 15th day and are not extended into the reconciliation section at the bottom of the sheet. This section has spaces for indicating on the debit side the trial balance at the beginning of the month, total debits from the footing of the control sheet, and debit cross charges, The credit side of the reconciliation has spaces provided for total credits, credit cross charges and the trial balance amount owed at the end of the month, to be carried forward to the new ledger sheets of the next month. This reconciliation may be better viewed by the following illustration of the calculation:

Chicago Office - Roofing A-K

	January 1	Trial Balance	$35,358.92	
Add:	January	Total Debits	21,436.84	
Add:	January	Cross Charges, Dr.	389.26	
				$57,185.02
Less:	January	Total Credits	23,038.29	
Less:	January	Cross Charges, Cr.	562.08	
				23,600.37
	January 31 Balance			$33,585.65
	February 1 New Trial Balance		$33,585.65	

Cross charges during the month are posted to a separate cross charge sheet, one for each office, and are summarized twice a month for purposes of reconciling trial balance totals.

20.7 Aging the Accounts Receivable Cards in Open File.

It is desired that the tabulation of the semimonthly trial balance report, in addition to showing the complete detail of every debit and credit item in the open file, listed to a net balance owed by each customer, should also indicate a separate classification of amounts overdue. The items from 1 to 30 days overdue, 31-60 days overdue, and more than 60 days overdue will all appear in different counters, summarized separately to net balances overdue. The machine is wired for multiple class selection through X - Distributors for this purpose. The 11th positions in the accounts receivable card from columns 29 through 40 govern this aging, representing the 12 months in the year. A particular X used for aging is gang punched into all accounts receivable summary cards of the current month. The following month the adjacent X to the right is used, and so the process continues. At the end of the year, the aging Xs are used over again, and a special plugging arrangement provides for the old overdue items which would conflict with the new aging. The aging X is nothing more than an overdue symbol punched in the accounts receivable card when the item is originated. If the charge still remains unpaid in the open file at the close of the "net" payment period, the amount will be automatically classified into an overdue counter for amounts from 1-30 days overdue.

If a 30 day overdue period elapses and this same charge is still unpaid, the amount will age in the 30-60 days overdue section. The automatic determination of the counters to which the overdue amounts will classify is obtained by changing the aging Xs in the X-Distributors plugged for multiple class selecting one column to the right prior to taking the accounts receivable trial balance at the end of each month. Supposing that the "net" payment is 60 days, in the trial balance taken on June 1, all unpaid items or credits not used in the open file dated prior to April 1 would be either overdue or not applied, respectively. Thus in June, X-34 would age the current month, X-33 would age May items not overdue, X-32 would age April items not yet overdue, X-31 would age March items from 1 to 30 days overdue, X-30 would age February items from 31 to 60 days overdue, and X-29 and prior Xs would determine the aging of items more than 60 days overdue. The importance of this aging is a paradox; for the automatic gang punching of the X is the simplest feature of the part of the accounts receivable tabulating application, yet provides the Credit Department with its chief benefit derived from the punched card system. This automatic aging of overdue amounts assists the Credit Department tremendously in dunning. It focuses attention upon the overdue items at regular intervals, helping to regulate dunning from the early routine stages to the advanced stages of demand notices and legal procedure. The cost, the speed, and the efficiency of dunning are all improved by the use of the aged trial balance.

20.8 Equipment

The Halliday Company employs tabulating machines for sales analysis, accounts receivable, and other uses. It has three seven bank numeric tabulators, of which two are equipped with duplicating summary punches. It requires two sorters, and several electric numeric punches. The seven bank tabulators have all five adding counters equipped for direct subtraction. Two verifying punches are needed for the work. Seven bank accounting machines are needed to provide maximum machine capacity for comprehensive reports. The Tabulating and Credit Departments are adjacent in physical location.

20.9 Filing Open Charges

As soon as the proven daily sales register has been tabulated for each ledger, the cards are released to clerks for filing into the open file. As each clerk receives the cards for a particular ledger, debits and credits separately, the cards are in perfect numerical sequence by customer number. The clerk makes use of a sorting needles to isolate the cards of each customer to be filed behind the visible index tab of the guide card in the open file. This tab is marked with the customer number. The needling process is a simple operation, since the clerk can usually separate accounts by referring only to the units and tens positions. Unbelievable as it may seem, clerks become as efficient in reading holes as they would in reading printed figures, and errors of reading and subsequent filing are surprisingly few.[84] The clerks always file cards newly added at the end of those cards already appearing in the file. Any confusion caused by filing

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cards belonging to one ledger into another, which appears occasionally, is revealed by the respective over and under variances between the ledgers which do not balance. Differences caused by the omission of individual charges may always be established by cross referencing the listing of the ledger against the sales register and the daily cash sheets. The inclusion of wrong cards is quickly established by the lack of continuity of ledger number and customer number.

20.10 Cash Application

About 80 per cent of all checks are received in the seven or eight day discount period following the 10th of the month. Two days are allowed for the clearing of the check through the customer's office, and this period, plus the normal mailing time from the point of origin determines whether or not customers are entitled to discount which they have taken. One or two extra days are allowed to customers located at remote points. Generally, the 17th is the dead line between discount allowance and net payment. Supposing that the terms of sale are 2% end of month, net 60 and that the month were June, checks for the period from April 25 through May 24 should be in the hands of the Halliday Company from June 10 to June 17 if discount is to be allowed. The procedure of cash application is to verify the items paid on the customer's remittance statement with the similar items on the last trial balance that was run. The discount rate is applied to those items for which discount is allowable to verify the customer's computation. The customer may claim any outstanding merchandise credits, freight

allowances, or overpayments which stand to his credit in the open file. The correct amount of cash should be remitted, plus the allowances, to determine the total amount paid. It is not so simple as it reads for there are many variations in the payment procedure. For example, when customers pay bills ahead of due date (assuming in this case that a customer on June 10 paid a May 29th invoice for $200, not due until July 10) they are allowed to deduct interest on their money for the number of days anticipation. Many customers often take discount to which they are not entitled, paying current bills with post-dated checks. Sometimes customers will use discount rates larger than the proper ones. A frequent variation consists of customers' claims of deductions which have not yet cleared through the accounting records of the Halliday Company; in such cases the deduction is used to apply the cash but is charged back to the customer by a deduction card in the open file. Conversely, if the customer overpays his balance, the amount overpaid is used in the cash application but the same amount is credited to the customer's account in the open file.

A simple example of cash application follows, with the accounts receivable trial balance indicating this date:

Customer Number	Date Mo.	Day	Yr.	Trans No.	Balance	1-30 Overdue	30-60 Overdue
53206	2	16	7	11	12500		12500
53206	3	15	7	11	7500	7500	
53206	4	20	7	11	4000		
53206	5	02	7	11	15000		
53206	5	15	7	33	1500 CR		
53206	6	04	7	11	20000		
					*57500	*7500	*12500

Inspection shows that the first two items paid are overdue, that the $40.00 charge of April 20 is outside the discount period and should be paid net, that the $150 item of May 2, less $9.00 freight prepaid, is entitled to discount, that the customer has used a $15.00 credit (punched X-69 in the card in the open file) and that the customer is entitled to interest anticipation on the June 4 charge of $200.00. Cash is always applied by writing the proper amounts in the dual section of the last open debit item. The application clerk pulls the six cards paid from the open file, and in the February 16 card she writes as follows:

6/12	Date Paid
85-362	Bank Number
567.42	Net Cash (includes $24.20 freight prepaid)
6.38	Cash Discount (2% of $319.00)
	Freight
1.20	Other Amount (Interest Expense)
575.00	Accounts Receivable

The accounts receivable footing is computed only to provide an added check to prove the cash application with the net amount paid by the pulled cards as indicated on the trial balance. The application clerk then takes a rubber stamp, dated June 12, and marks the impression of the date opposite each item paid on the trial balance. When the card has been applied for all accounts in the ledger, the pulled cards are punched for cash application, the cash sheet is tabulated and proven, and the checks, together with the deposit slip and expense distribution are sent to the Accounting Department. The trial balance is returned to the Credit Department as soon as possible in order not to delay passing orders in absence of the trial balance from

the Credit Department. It should be brought to mind that whereas the Credit Department has a record of every payment made until the new trial balance is run, it does not know the current interim charges filed in the open file without consulting the sales register or requesting a special report on any account in question.

A further example of each application will illustrate deductions and overpayment, no freight charges involved.

Customer Number	Date No.	Day	Yr.	Trans. No.	Balance	1-30 Overdue	30-60 Overdue
12625	4	19	7	11	300 00		
12625	4	25	7	11	500 00		
12625	4	29	7	11	800 00		
12625	5	23	7	11	1000 00		
12625	5	24	7	11	400 00		
					*2000 00		

In this instance the customer remitted a check for $1774, claiming discount of $26.00 and a deduction for merchandise returned on June 6 from the May 23 shipment amounting to $200. Examination disclosed that the customer had incorrectly taken discount on $300 of April 19, had neglected period discount on $500 of April 25, and had claimed a deduction of $200 upon returned merchandise for which no credit had yet been issued. The correct cash application is indicated by the entry

Dr.	Cash	1774.00	
Dr.	Sales Discount	30.00	
Cr.	Accounts Receivable		1804.00

It will be noted that the customer properly deducted the $200 of returned merchandise from the amount eligible for discount. It will also be noted that the net effect of the customer's two mistakes was to overpay the account $4.00.

The correction between the cash sheet and the customer's account in the open file is accomplished by debit and credit adjustment cards punched in the accounts receivable field as follows:

Open File

Dr.(No X-69)	Merchandise Deduction,Transaction 13	200.00	
Dr.(No X-69)	Cash Discount Deduction,Transaction 12	6.00	
Cr.(X-69)	Overpayment, Transaction 36		10.00

Cash Sheet

Dr.(No X-69)	Accounts Receivable,Transaction 22	10.00(Disc.All'd)	
Cr.(X-69)	Mdse. Deduction,Transaction 13		200.00
Cr.(X-69)	Cash Discount Deduction " 12		6.00

In other words there are two sides of adjustments of cash application, handled by debit and credit cards punched either X or No-X in column 69, through the accounts receivable field. The punching of a credit X in column 69 does not imply that this subtracting pays any amount due; rather, it adjusts the accounts receivable net balance, when the adjustment cards are used, to the amount still owed or overpaid.

20.11 Partial Payments

Up to this point, cash application has been considered only from the standpoint of pulling fully paid cards from the open file. In the case of partial payments, no cards may be pulled from the open file, and a credit card punched X-69 in the accounts receivable field must be added to the open file. The other side of the transaction is to punch a card for the cash book with the amount recorded in both the net cash and accounts receivable fields, thus providing for both the money received and the crediting of the customer's account. The trial balance is marked with the

date in pencil, and the notation "partial payment" beside the amount paid. The tabulation of the customer's account from the open file will show the correct net amount due. When any future remittance balances the net amount owed so that debits and partial payment credits in the open file may fully pay certain items, all cards affected may then be pulled and the trial balance may be stamped in the usual manner.

20.12 Punching the Cash Application

It was previously mentioned that the last open debit of a group of paid cards was used for recording the distribution of the payment in the dual part of the accounts receivable card. This section embraces the following tabulating card fields:

Distribution	Field	Card Columns
	Transaction	9-10
6/7	Date Paid	11-15
10-340	Bank Number	16-20
1774.00	Net Cash	21-27
30.00	Cash Discount	28-32
	Freight	76-80
	Other Account	33-35
	Other Amount	36-40
1804.00(Not punched) (Punch Adjustments only)	Accounts Receivable	

The dual columns filled with the cash application appear at the extreme left of the card so that the punch operator may see the figures to be punched when the card is inserted in her machine. The punch operator does not see the checks at all. The adjustment cards, addressographed with proper punching instructions and posted for adjustment amounts, are prepared for her by the cash clerk. Except for the freight field the punching order follows the horizontal punching sequence of the tabulating card. The punch clerk perforates

the entire detail of the cash application in the proper columns of the last open debit. In all of the charges paid, she duplicates the date of payment so that when the paid cards are later posted to the history sheet the record will show both the date of shipment and the date paid. One check may conceivably pay 100 charges in the open file. The distribution of the payment will be punched only in the oldest outstanding charge paid, but the date of payment must be duplicated in the other 99 cards. The date of payment is not recorded in merchandise credits applied, for the customer's account was in reality credited and paid when the credit was issued; overpayment and partial payment credits when used from the open file are similarly not punched in the date paid field.

20.13 Running the Daily Cash Sheet

A control over cash received is effected by sorting the checks and other cash received by ledger and listing the amounts on an adding machine tape for total. The tape indicates the bank number on which the check was drawn or identifies the payment as a money order. Actual cash is only occasionally received through the mail from small accounts, but is deposited with checks when obtained. Cash items such as stamps, which are not to be deposited, are received in the Tabulating Department on a memorandum for use in proving the control.

The cash sheets are run daily in the seven bank accounting machine as illustrated in the following table:

Location	Card Field	Card Columns	Sample Posting
List Bank 1	Customer No.	60-61x64-68	61 19342
List Bank 2	Bank No.	16-20	10 380
Counter 3	Net Cash	21-27	199659
Counter 4	Discount	28-32	4181
Counter 5	Freight	76-80	5968
Counter 6	Other Amount	36-40	192
Counter 7	Accounts Rec.	69-75	210000

The credit to accounts receivable is obtained from the summarization of the original charge and merchandise credit amounts, punched in the accounts receivable field, modified by any adjustment cards required by the cash application. In the above illustration, the trial balance showed a $2250 net customer balance, but the customer claimed a merchandise deduction of $100.00 and an advertising deduction of $50.00. While all the charge cards totaling $2250.00 are pulled from the open card file, two adjustment cards subtract the $150.00 amount deducted when preparing the cash sheet, crediting the customer with a payment of only $2100.00. The merchandise and advertising deduction cards are charged to the customer in the open file, to be either credited later by a credit invoice or cross charge on by additional remittance from the customer. The sum of the distribution of the payment in the spread fields of the tabulating card balances the amount paid, in accordance with the journal entry as follows:

Dr	Cash	1996.59	
Dr	Sales Discount	41.81	
Dr	Freight and Express	59.68	
Dr	Interest Expense	1.92	
Cr	Accounts Receivable		2100.00

An illustration of the preparation of the cash sheet is located in the appendix, report 8.

The balancing of the cash receipts and the expense

distribution for each ledger is obtained by parallel balance through cross footing the distribution fields to check with the net balance from the accounts receivable field. The total from the net cash counter must prove with the predetermined totals from the adding machine tape for checks received. If the net cash field does not prove, the cash field was punched in error. If the distribution does not balance with accounts receivable, either some mistake was made in applying cash or the punching in the distribution or accounts receivable adjustment cards was incorrect. The cash sheet must be proven exactly. When found to be in balance, the proven machine total of the accounts receivable field, representing the day's credits to accounts receivable for each ledger is posted to the control sheet.

The first three printing banks of the machine register the customer number, the bank number, and the net cash. A perforated stub is attached to the left hand vertical margin of the cash sheet so that a carbon copy of these three counters may be prepared simultaneously with the preparation of the cash sheet. This carbon copy serves as the bank deposit slip which lists each check deposited and which accompanies the checks when sent to the bank. The detail shown on the bank deposit slip should correspond exactly with the adding machine tape of checks listed for control purposes.

Counters 3, 4, 5, 6, and 7 provide the footings of cash received, sales discount, freight and express expense, interest expense or other account and accounts receivable which are posted as summary entries to the controlling accounts

in the general ledger. These totals are typewritten by the control clerk on a summary form provided for the purpose consisting of three sheets posted daily. Each sheet represents one of the three distinct summaries for each product division (roofing materials, floor covering, and corrugated boxes) and every line on each sheet is posted with the cash distribution of each ledger. Each of the the three sheets is cross footed to provide the following summary entry for the controlling accounts:

Dr	Cash Received
Dr	Sales Discount
Dr	Freight and Express
Dr	Interest Expense or other Account
Cr	Accounts Receivable

The proven tabulating cards are released by the control clerk for posting to the history sheet which lists all the items in the paid file. The cash sheets are bound in a reference binder daily.

20.14 Listing of the Aged Accounts Receivable Trial Balance

The cash sheet just described was prepared by tabulating each customer's net balance paid with the automatic control switch set for minor control. In other words, only one line of horizontal registration appears on the cash sheet, though 50 cards may enter into the tabulation. An exception to the above statement occurs in instances when customers may pay bills with more than one check, drawn either on the same or different banks, in which instances the checks must be tabulated separately for the sake of itemization on the bank deposit slip.

The aged trial balance is prepared twice a month for all accounts, on the 15th and on the 31st. Whereas the cash

sheet is a tabulated report, the aged trial balance is listed. Inasmuch as manually posted ledger cards are completely eliminated by the punched card method (except for balance forwarding each ledger card posting in the case of the Halliday Company) the Tabulating Department must provide the Credit Department with the complete detail of every accounts receivable transaction. In the listing process every debit and credit card in the open file, identified by the date and kind of transaction, is listed in the customer balance counter, which totals the net customer balance as the control changes from the customer being tabulated to a new one. In the last four counters of the machine the items owed are distributed according as they represent current or overdue amounts. It was previously pointed out that all debit and credit cards prepared for the open file are automatically punched with an X in one of the columns from 29 through 40, which represent the 12 months of the year. Controlling counters 4, 5, 6, and 7 by successive X's through the process of multiple class selection as each month goes by, accomplishes the function of distributing the charges or credits as current, 1-30 days overdue, 31-60 days overdue, or more than 60 days overdue items. Just prior to listing the accounts receivable trial balance at the end of each month, the aging X control positions are shifted in the plugboard panel to bring the new periods of overdue classification into the wiring circuit. It is noteworthy that the aging is not changed when the trial balances on the 15th are run.

The information which appears in the listing of

the trial balance is arranged herewith.

Print Banks	Aging X Control - June 1	Total Aged Amounts
1 Customer		
2 Date, Trans, Terms		
3 Customer Balance		78598
4 Current	X-33, X-32	25190
5 1-30 Days Overdue	X-31 (March)	38450
6 31-60 Days Overdue	X-30 (February)	10896
7 More than 60 Days Overdue	X-29, etc (January (and before)	4062

The plugging of the tabulator for the aged report represents a comprehensive wiring plan, since all five balance counters are controlled by X-69 for direct subtraction and since each aged counter is controlled by aging X's in a multiple class selection circuit. This report illustrates to a high degree the automatic, flexible, speedy features of an accounting machine. It takes far less time to run a completely itemized trial balance by tabulating machine, with a resulting transcription of the entire detail of each ledger than merely to take a trial balance manually in the bookkeeping machine method by picking off total current balances. The punched card method provides the feature of automatic aging of every item in the open file, while aging under the bookkeeping method is a separate, unwieldy, laborious operation. An example of the aged trial balance is found in report 9 of the appendix.

While on the subject of comparison of speed and accuracy between the punched card method and the bookkeeping method it should be mentioned that all machine operations of the tabulating method are many times faster, as a whole, than the same operation under the system of manually operated bookkeeping machines.[85] The automatic punching of accounts receivable

85 Conference with J.L.Carichoff. I.B.M. salesman

cards by the summary punch is faster than machine posting from invoices. While the cash application is somewhat slower under the tabulating plan, the punching of cash, tabulation of the cash sheet, and posting of control is much faster than the cash sheet posting by the bookkeeping method. The running of the aged trial balance is much quicker than the preparation of a similar aged trial balance under the manual plan. In the Halliday Company, the trial balances must at present be decoded because of use of numeric tabulators, a slow operation, but a contemplated change to alphabetic equipment for accounts receivable work will shortly remove this difficulty. Statements can be prepared several times faster by tabulating machine than by bookkeeping machine. The punched card system has certain unfavorable aspects, apart from Credit Department objections to be mentioned later. The filing of open cards, the posting of history sheets, and the filing of paid cards are all additional operations incurred by the tabulating scheme.

Returning to discussion of the accounts receivable trial balance, this is the work sheet of the punched card plan of accounts receivable control. Since it indicates the credit limit and credit rating of each customer, the date and kind of transaction, the terms, the amounts of each outstanding item in the open file and classifies them as current or overdue, it contains the information upon which credit judgment may be exercised in passing orders. Since cash is posted to the trial balances daily, the Credit Department has full information about the net outstanding balances and

the payment progress of each customer.

Concerning the question of open charges added on the books in the interim 15 day period before new trial balances are available, the Credit Department is not especially concerned with the purchases of representative large accounts or well managed small business in good credit standing. These accounts contribute the most to sales volume and cause the least difficulty from a credit point of view. It is the small accounts of low rating, which must be placed on low limits, which pay slowly, and which cause the greater part of credit losses that create the most trouble. The delinquent or doubtful accounts are indexed with red tabs in the accounts receivable file. Some of these accounts may be tabulated daily or weekly on a condition report form especially provided for the purpose. The Credit Department often calls for information about the net balance of these accounts by telephone. In many instances information request slips are sent through the office mail, which circulates through departments at half hour intervals. The file clerks in the Tabulating Department closely watch the filing of open charges for doubtful accounts to verify that the home office and branch shipping points do not deliver large shipments of goods to poor accounts at the same time without having immediate information to stop further shipping until existing charges are paid. In order to keep the branch offices aware of the credit standing of accounts at the main office each branch receives a copy of each semimonthly trial balance and a copy of the daily cash sheet.

A most important function of the aged trial balance

is the segregation of overdue items into overdue periods. The distribution of overdue amounts into three overdue counters serves to simplify and regulate the dunning procedure. Under the bookkeeping method it is necessary for account supervisors to examine their ledgers repeatedly at irregular intervals to select for dunning those accounts which are overdue or those whose payment habits require account revision. Under the tabulating method the overdue items are automatically selected, and their appearance in the last three counters of the machine instantaneously focusses the attention of the Credit Department upon the accounts requiring dunning and the stage of dunning progress. A splendid feature of the tabulating system is the aging of partial payments directly into the proper overdue counter so that the Credit Department may see at a glance that the net amount of overdue still owed. The credit manager turns to the overdue totals the moment he receives a new trial balance.

It is sometimes advisable to punch dunning cards for the early form letter stages of dunning. These cards are removed as items become paid, but up to the time of payment the dunning steps may be indicated by a coded symbol for a form letter and the date directly on the trial balance. This procedure enables the credit manager to devote more of his personal time to the oldest overdue amounts outstanding that require the most effective collection tactics. A concern which uses alphabetical equipment may add brief dunning messages to the open file to appear on customer statements such as the phrase "YOU PROMISED TO SEND US A CHECK JUNE 10."

The effectiveness of dunning and collection because of regular recurrence of overdue amounts on successive trial balances is unquestionably improved by the aged trial balance. In the Halliday Company the ratio of bad debt loss for 1937 was .08 per cent of sales, an enviable record.

20.15 Posting the History File

It is necessary for the Credit Department to be supplied with a permanent record, in ledger form, of the history of paid transactions of all customers. The history sheet is necessary for credit reference when account ratings are revised semiannually. It is especially valuable in identifying those accounts which are frequently delinquent and which continually make use of unfair practices. In such cases proper credit action is taken to lower the credit status of undesirable accounts or even to close them entirely. It is just as important to revise accounts upward as downward, especially in the case of new accounts. The Credit Department receives many requests from the credit agencies, creditors, and other interested sources for information about customer credit standing.

The information required for accounts receivable history is arranged in machine printing banks as shown in the ensuing diagram:

Location	Card Fields	Columns
List Bank 1	Account and Pro. No.	64-68x56-59
List Bank 2	Dr Date and Transaction	46-47x48-49x50x44-45
Counter 3	Accounts Receivable,Dr.(Cr.)	69-75 (CR)
Counter 4	Cr Date and Trans.	11-12x13-15x9-10
Counter 5	Net Cash	21-27
Counter 6	Discount and Other Amount	29-32x37-40
Counter 7	Freight	76-80

A specimen of the accounts receivable history sheet appears in the appendix, report 10. The history sheets are posted daily by listing the paid cards released from the cash proving operation to the ledger sheets. A helpful automatic feature of the accounting machine, called"preindication" is available to assist in the ledger card position. The tabulating cards, in perfect order by numerical sequence, are placed in the card feed as a continuously feeding group. As the last item of the customer being tabulated to the ledger card in the machine is posted, an impression of the customer indication next in order is printed on the completely posted card ready to be removed from the machine. This enables the machine operator to refer directly to the ledger file to select the next history sheet to be posted, thus enabling the tabulating cards to be fed automatically while selecting ledger sheets manually.

The history file shows complete detail for each accounts receivable transaction both on the debit and credit side of the account. Beside each charge posting is indicated the debit date and debit transaction and the payment date and kind of transaction. The distribution of the payment data is completely itemized. Thus in view of the repetition of the payment date and the punching of cash in the last debit paid, one is usually enabled to identify quickly the remittance data which paid any particular series of charges. The postings of the cash and expense distributions must always check with net balances obtained from the accounts receivable field by the method of parallel balance. Since the history ledger card

provides the distribution of the cash sheet as a permanent part of the paid ledger card, more information is available for use by the Credit Department than is available under the bookkeeping system. The history sheet of each customer shows division and ledger number, account number, customer, and addresses in typewritten form at the top of the sheet. Following the completion of the listing of history sheets, the tabulating cards are needle filed into the paid section of each ledger.

20.16 The Tabulation of Monthly Statements

Monthly statements are generally prepared for only the accounts in good credit standing who wish them. Customers who purchase more than one of the three major product divisions always receive monthly statements. The main exigency for monthly statements, however, arises from delinquency. The Credit Department usually requests that a monthly statement be sent to a customer, following failure to pay promptly after the first reminder form letter. Certain customers who are habitual offenders of one sort or another are placed on the statement list. Statements are usually sent to those accounts in good credit standing whose internal accounting systems are so faulty that they are continually sending incorrect remittances; in these instances, statements serve to keep the account in balance.

The monthly statement is prepared from five counters of the tabulator as follows:

List Bank 1	List Bank 2	Counter 3	Counter 4	Counter 5
Customer Number	Mo. Day Yr. Trans	Debits	Credits	Balance
62-63x64-68	46-47x48-49x50x44-45 11-12x13-14x15x9-10	69-75(No-X69)	69-75CR(X-69)	*69-75 Net

The customer name, address, and terms are addressographed on the statement form. The complete debit and transaction codes affecting monthly statements appear in the right corner above the body of the bill. The statement is heavily scored between the first and second print banks so that the customer number section may be detached before the completed statements are released for mailing. The statement period begins after the 24th of each month and The Halliday Company has the statements in the mail by the 1st of the next month in order that customers may have adequate time for preparing checks when bills become due on the 10th. A completed statement form is furnished in the appendix, report 10.

20.17 Advantages of the Punched Card Method for Accounts Receivable

The Credit Department derives certain unquestionable advantages from a properly installed and operated punched card system for accounts receivable.[86] In a company where the volume of transactions is large, less personnel is required in the Tabulating and Credit Departments to perform all accounts receivable functions than is required by a manual bookkeeping department and a credit department. An important executive of the International Business Machines Corporation who has specialized in accounts receivable punched card systems has recently stated that one clerk on the tabulating basis should do the work of two under the manual machine method. Certain reasons are apt to cause economy in Credit Department personnel. In the first place, credit supervisors are enabled to work at their desks with up to date trial balances at their finger tips

(86 Advantages indicated by tabulating supervisor, Halliday Co.)

and are not compelled to make dozens of references a day to accounts receivable ledger cards. The obvious factor affecting personnel is this. The tabulating machines are so much faster in most accounts receivable functions that the more complex the problem, the greater the likelihood of saving in personnel cost.

The efficiency of the Credit Department is undoubtedly improved. While the credit supervisors cannot answer all questions from the trial balances, especially as the period nears the preparation of new reports, facilities are provided through use of the telephone, the information request form for written customer balances, and special daily statements for doubtful accounts of poor rating which supply the missing facts. The necessity of scrutinizing ledger cards to seek overdue accounts is eliminated entirely, a factor of saving in cost of dunning. The aging of overdue regularly and the methodical reporting of daily payments enforces more direct attention to dunning action. The facts are not buried in a ledger file for discovery if one looks for them but always available on the credit supervisor's desk. This all results in better collection experience, for supervisors, with much less personal investigating to do, can devote more energy to their correspondence and other more important features of their daily tasks.

While under the manual system the aging of overdue items by periods is too costly a task, under the punched card plan it costs next to nothing. It is important to indicate that this chief advantage to the Credit Department is

spectacular since the aging is so simply performed. The accounts receivable trial balance provides more specific information as to type of transaction than does the manually posted ledger card. The history sheet is more valuable than the ledger card because it represents the detailed analysis of the customers purchasing and payment habits. The cash distribution schedule of the history sheet represents additional information not provided by the ledger card.

The branch offices derive much benefit from the punched card system for they receive copies of the trial balances and the daily cash sheets. By posting the cash they have specific information on which to base their decentralized credit judgment. This knowledge speeds delivery in valid instances and prevents delinquency or losses in other cases.

The aging of the trial balance permits the determination of standards of overdue by period and ledgers, providing data which month by month becomes a measuring stick of collection efficiency. Season by season and year by year certain trends of overdue balances will be evident in the ledgers, guiding the credit policy and directing the degree of pressure or leniency utilized in passing orders, in setting credit limits, and in dunning practice. It is easy to see that the establishment of these overdue standards automatically by tabulating machines provides a splended managerial basis for judging the efficiency of the Credit Department.

Monthly statements are far more simply prepared, since the tabulating machine strokes register at a rate of 120 impressions a minute.

The errors that arise in daily accounts receivable routine are more quickly discovered by taking a trial balance of ledgers twice a month.

In all industrial bookkeeping systems, posting is apt to run behind both during the period of taking trial balances and peak intervals of heavy billing. Under the punched card method there is positive assurance that trial balances will be obtained on time and that punched cards will be filed in the open file on a daily basis.

20.18 Disadvantages to the Credit Department

Under the punched card system, the ledger cards of the bookkeeping system are eliminated. The abandonment of balance forward amounts of the ledger card causes definite inconveniences. When applying cash, for instance, in most cases the balance forward amount will indicate the exact credit to accounts receivable for the items paid. The accumulative charge total indicates the high credit definitely whereas on the other basis the amount owed often has to be calculated. The Credit Department must utilize time in requesting information from the Tabulating Department. A disadvantage because of location exists if the Credit Department and Tabulating Departments are not placed adjacent to one another. This disadvantage may be removed by locating the punched card ledgers in the Credit Department. Because machines and filing clerks have almost exclusive contact with tabulating cards, the credit supervisors lose definite personal contact with individual accounts. Benjamin Franklin said: "If you wish a thing done well, you must do it yourself."

Accordingly, the credit supervisor must be cautious not to take the trial balance too much for granted and fail to assume the responsibility of his work; he must frequently look beyond the trial balance for the facts behind its implications. The Credit Department must look in two places for a customer's complete record - the trial balance and the ledger sheet. Sometimes this record must be supplanted by a further special statement from the open file. Finally, there is a distinct disadvantage in loading into the Tabulating Department the two functions of sales account and accounts receivable application which are both subject to the same degree of fluctuation in volume during peak period.

21.0 Finished Stock Inventory Control at the Merrill Company, Denver, Colorado

21.1 Reasons for Centralized Inventory Control

The Merrill Company manufactures 2500 different types of electric motors, counting all the variations of model number, horse power, revolutions per minute, volts, phase, cycles, bearings, and class. Motors are distributed from the main plant at Denver or from any of the 35 branch warehousing points. On January 1, 1934 there were 45,000 motors in factory warehouse and branch stock. The stock turnover of individual motors was averaging 6 to 9 times ayear. Extreme difficulties were being experienced because branch managers were not placing orders with the factory sufficiently rapidly to keep their stocks up to standard authorization. It frequently happened that branch managers were obliged to place rush orders for certain motors because they had allowed their stock to fall below limit. In other instances, branches were overstocked with motors far in excess of requirements, with more than sufficient quantities on hand to fill their demand until the motor model was obsolete. In remote instances the stock on hand had been rendered completely out of date by changed conditions. In most cases the depleted stock of one district office could have been temporarily or permanently replenished from some other district office; at least, the stock balance could have been preserved until new manufacturing could restore the weakness. It was obvious that the Distributors did not possess all the facts for proper administration, that the company had too great an investment placed in slow moving items, and that the items subject to rapid turnover were not being supervised by

adequate control. A change in policy was originated on January 1, 1934, when the Merrill Company adopted a punched card system of inventory control for all stocks of finished motors.

21.2 Tabulating Card Forms Used

To start the perpetual inventory system as of January 1, 1934, a company wide physical inventory was compiled and evaluated at each warehouse location point. A master coding card was adopted to classify the motor numbers, and an addressograph plate was cut in large type to identify the numbers and letters composing the specifications of each motor. A value was established for each kind of motor by the motor costing unit. Apparatus number was also coded. Inasmuch as the identifying information for motor number required the punching of 44 positions in columns 51-80 of the tabulating card, it was immediately found necessary to adopt an additional six digit block numeric code to permit operating convenience for tabulating machines. Inasmuch as reports are prepared on an alphabetic tabulator, a sort upon 44 punched positions would have been required to prepare cards for tabulating. The numeric motor code, punched in columns 5-10 of the tabulating card, permitted direct sorting to proper serial number sequence, on simple six digit basis.

The following tabulating cards were found necessary to operate the control system.

Exhibit 15 - Red Striped Master Coding Card, punched with motor number, apparatus, number, and value, originated in the factory warehouse.

Exhibit 16 - Manila Inventory Card, gang punched from the Master

Coding Card, identifying stock on hand at each warehouse location.

Exhibit 17 - Salmon Striped Detail Card, gang punched from the Master Coding Card, sent to the Tabulating Department for use in the central office file to designate input to the factory warehouse.

Exhibit 18 - Manila Reproduced Detail Card, reproduced from the Manila inventory, sent to district office when motors are requisitioned, representing output from factory warehouse in the tabulating control file.

Exhibit 19 - Red Striped Summary Card, representing total number of motors of each kind on hand at the beginning of the month for each location in the tabulating control file.

Exhibit 20 - Green Striped Detail Card, indicating transfers and customer returns into warehouse stock. Grey striped cards, not illustrated, denote transfers out of branch office stock.

All of these card forms were adopted in 1934 and are in use today with no change.[87] To record the original inventory, a manila inventory card, addressographed with motor number, was gang punched from the master coding cards for each motor in each warehouse. The inventory cards for the motors in each warehouse were gang punched with district office number. All inventory cards of each district were then tabulated by district, motor number, quantity on hand, and value to provide the value of the opening inventory on hand in each district office, and a summary card was obtained for the quantity of each

87 - Statement of tabulating supervisor. The Merrill Co.

Exhibit 15

MODEL 5K 204 A2
K-204-1HP-1800
220/440V-3-60
SLEEVE BEARING

SERIAL NUMBER | DATE RECD. B.O.

Master Coding Card

CARD COLORS
MANILA-FOR EACH ITEM ON HAND.
GREEN STRIPE - TO NOTIFY WORKS OF TRANSFERS AND RETURNS RECEIVED

TRANSFERRED TO -
TRANSFERRED FROM - RETURNED BY -
SHIPPED DIRECT BY WORKS TO CUSTOMER IN DISTRICT NO. -

D TRANSFERRED OUT | L C. DIF. | M APP. AC. | N WORKS | O COSTS NO-6 YES-7 | P VALUE | Q BOXING
E COUNT AS SALE | J WORKS REF. NO. | K O.O. | DATE OUT OF WORKS
F REPLACE NO YES | O.O. REFERENCE NO.
PUR.-INO.-USER G H | I CUSTOMER | C DATE OUT OF O.O. | A COP. B.

CP. B. A | QUAN. B | MO. C | DEF G | PUR. | USER H | CUST'M I | WKS. M/S J | O.O. K | C. DIF. L | APP. M | W K N | O | VALUE P | BOXING Q | MODEL NO. R | N.P. S | R.P.M. T | VOLTS U | P V | C W | B X | CLASS Y

I.B.M. 523226 252 LICENSED FOR USE UNDER PATENT 1,772,492 K.W. 6900 (3-25)

THE MERRILL CO.

Exhibit 16

MODEL 5K 204 A2
K-204-1HP-1800
220/440V-3-60
SLEEVE BEARING

SERIAL NUMBER | DATE RECD. B.O.

Inventory Detail Card

CARD COLORS
MANILA-FOR EACH ITEM ON HAND.
GREEN STRIPE - TO NOTIFY WORKS OF TRANSFERS AND RETURNS RECEIVED

TRANSFERRED TO -
TRANSFERRED FROM - RETURNED BY -
SHIPPED DIRECT BY WORKS TO CUSTOMER IN DISTRICT NO. -

D TRANSFERRED OUT | L C. DIF. | M APP. AC. | N WORKS | O COSTS NO-8 YES-7 | P VALUE | Q BOXING
E COUNT AS SALE | J WORKS REF. NO. | K O.O. | DATE OUT OF WORKS
F REPLACE NO YES | O.O. REFERENCE NO
PUR.-INO.-USER G H | I CUSTOMER | C DATE OUT OF O.O. | A COP. B.

CP. B. A | QUAN. B | MO. C | DEF G | PUR. | USER H | CUST'M I | WKS. M/S J | O.O. K | C. DIF. L | APP. M | W K N | O | VALUE P | BOXING Q | MODEL NO. R | N.P. S | R.P.M. T | VOLTS U | P V | C W | B X | CLASS Y

I.B.M. 523226 252 LICENSED FOR USE UNDER PATENT 1,772,492 K.W. 6900 (3-25)

THE MERRILL CO.

Exhibit 17

MODEL 5K 204 A2
K-204-1HP-1800
220/440V-3-60
SLEEVE BEARING

SERIAL NUMBER | DATE RECD. B.O.

Input to Factory Warehouse

CARD COLORS
MANILA-FOR EACH ITEM ON HAND.
GREEN STRIPE - TO NOTIFY WORKS OF TRANSFERS AND RETURNS RECEIVED

TRANSFERRED TO -
TRANSFERRED FROM - RETURNED BY -
SHIPPED DIRECT BY WORKS TO CUSTOMER IN DISTRICT NO. -

D TRANSFERRED OUT | L C. DIF. | M APP. AC. | N WORKS | O COSTS NO-6 YES-7 | P VALUE | Q BOXING
E COUNT AS SALE | J WORKS REF. NO. | K O.O. | DATE OUT OF WORKS
F REPLACE NO YES | O.O. REFERENCE NO.
PUR.-INO.-USER G H | I CUSTOMER | C DATE OUT OF O.O. | A COP. B.

CP. B. A | QUAN. B | MO. C | DEF G | PUR. | USER H | CUST'M. I | WKS. M/S J | O.O. K | C. DIF. L | APP. M | W K N | O | VALUE P | BOXING Q | MODEL NO. R | N.P. S | R.P.M. T | VOLTS U | P V | C W | B X | CLASS Y

I.B.M. 523226 252 LICENSED FOR USE UNDER PATENT 1,772,492

THE MERRILL CO.

Exhibit 18

SUMMARY AND REPRODUCED CARD

6 – NO COSTS
7 – COSTED

A – RW. – TOTAL CUMULATIVE DISBURSEMENTS
9 – OO. – CURRENT ORDER TOTAL

Output from Fact. Warehouse

MOTOR CODE	MO	SCT	CUM NO. OF SALES	ON HAND	AUTHORIZE	CUM QUAN. SOLD	O.O	APP	W.K.	CURRENT NO. OF SALES	CURRENT QUAN SOLD	A / B	MODEL NO	H.P.	R.P.M.	VOLTS	P	C	B	CLASS
0000	000000	00	000	000000	000000	000000	00	000	0	000000		0000	000000000000000000	000	000	000	0	0	0	00
SUMMARY																				
111	111111	11	111	111111	111111	111111	11	111	1	111111		1111	111111111111111111	111	111	111	1	1	1	11
22	222222	22	222	222222	222222	222222	22	222	2	222222		2222	222222222222222222	222	222	222	2	2	2	22
33	333333	33	333	333333	333333	333333	33	333	3	333333		3333	333333333333333333	333	333	333	3	3	3	33
44	444444	44	444	444444	444444	444444	44	444	4	444444		4444	444444444444444444	444	444	444	4	4	4	44
55	555555	55	555	555555	555555	555555	55	555	5	555555		5555	555555555555555555	555	555	555	5	5	5	55
66	666666	66	666	666666	666666	666666	66	666	6	666666		6666	666666666666666666	666	666	666	6	6	6	66
77	777777	77	777	777777	777777	777777	77	777	7	777777		7777	777777777777777777	777	777	777	7	7	7	77
REPRODUCED																				
88	888888	88	888	888888	888888	888888	88	888	8	888888		8888	888888888888888888	888	888	888	8	8	8	88

CP B (A) | QUAN (B) 9 | MOTOR CODE | MO (C) | S (E) | WKS M/S (J) | O.O (K) | C. DIF (L) | APP. (M) | W K (N) | O | VALUE (P) | BOXING (Q) | MODEL NO (R) | H.P. (S) | R.P.M (T) | VOLTS (U) | P (V) | C (W) | B (X) | CLASS (Y)

THE MERRILL CO.

I.B.M. 523684 — 252 — LICENSED FOR USE UNDER PATENT 1,772,492

Exhibit 19

SUMMARY AND REPRODUCED CARD

6 – NO COSTS
7 – COSTED

A – RW. – TOTAL CUMULATIVE DISBURSEMENTS
9 – OO. – CURRENT ORDER TOTAL

MOTOR CODE	MO	SCT	CUM NO. OF SALES	ON HAND	AUTHORIZE	CUM. QUAN. SOLD	O.O	APP	W.K.	CURRENT NO. OF SALES	CURRENT QUAN SOLD	A / B	MODEL NO.	H.P.	R.P.M.	VOLTS	P	C	B	CLASS
0000	000000	00	000	000000	000000	000000	00	000	0	000000		0000	000000000000000000	000	000	000	0	0	0	00
SUMMARY																				
111	111111	11	111	111111	111111	111111	11	111	1	111111		1111	111111111111111111	111	111	111	1	1	1	11
22	222222	22	222	222222	222222	222222	22	222	2	222222		2222	222222222222222222	222	222	222	2	2	2	22
33	333333	33	333	333333	333333	333333	33	333	3	333333		3333	333333333333333333	333	333	333	3	3	3	33
44	444444	44	444	444444	444444	444444	44	444	4	444444		4444	444444444444444444	444	444	444	4	4	4	44
55	555555	55	555	555555	555555	555555	55	555	5	555555		5555	555555555555555555	555	555	555	5	5	5	55
66	666666	66	666	666666	666666	666666	66	666	6	666666		6666	666666666666666666	666	666	666	6	6	6	66
77	777777	77	777	777777	777777	777777	77	777	7	777777		7777	777777777777777777	777	777	777	7	7	7	77
REPRODUCED																				
88	888888	88	888	888888	888888	888888	88	888	8	888888		8888	888888888888888888	888	888	888	8	8	8	88

CP B | QUAN (B) 9 | MO OR CODE | MO | S (E) | WKS M/S (J) | O.O (K) | C. DIF (L) | APP. (M) | W K (N) | O | VALUE (P) | BOXING (Q) | MODEL NO (R) | H.P. (S) | R.P.M (T) | VOLTS (U) | P (V) | C (W) | B (X) | CLASS (Y)

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Exhibit 20

Transfers In and Sales

SERIAL NUMBER | DATE RECD O.O.

CARD COLORS
MANILA – FOR EACH ITEM ON HAND.
GREEN STRIPE – TO NOTIFY WORKS OF TRANSFERS AND RETURNS RECEIVED

(D) TRANSFERRED OUT 9	(L) C. DIF.	(M) APP AC.	(N) WORKS	(O) COSTS NO-8 YES-7	(P) VALUE
(E) COUNT AS SALE 1	(J) WORKS REF. NO.		(K) O.O.	DATE OUT OF WORKS	
(F) REPLACE NO 3 YES X	O.O REFERENCE NO.				
PUR.-IND (G) - USER (H)	(I) CUSTOMER		(C) DATE OUT OF O.O.		(A) COP. B.

(Q) BOXING

TRANSFERRED TO –

TRANSFERRED FROM – RETURNED BY –

SHIPPED DIRECT BY WORKS TO CUSTOMER IN DISTRICT NO. –

CP B (A)	QUAN (B) 9	MO (C)	T (D) 9	S (E)	R (F)	PUR (G)	USER (H)	CUST'M (I)	WKS. M/S (J)	O.O. (K)	C. DIF. (L)	APP (M)	W K (N)	O	VALUE (P)	BOXING (Q)	MODEL NO. (R)	H.P. (S)	R.P.M (T)	VOLTS (U)	P (V)	C (W)	B (X)	CLASS (Y)

THE MERRILL CO.

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item simultaneously with the preparation of this report. In the tabulating control file a section was alloted to each warehouse and the summary cards were filed by motor number. The manila inventory cards from which the tabulation was prepared were sent to district offices for originating a similar motor file. In this way, a manila card in a warehouse file represented an individual motor, and the value of each card was a part of the value in the summary card in the tabulating control file for which the district office was charged.

Parenthetically, it is pointed out that authorizations for producing motors were modified on a more equitable basis. Obsolete motors were disposed of locally at reduced prices. Special direction was given to adjusting the stocks of each warehouse so that maximum turnover could be ensured from smaller salable stocks.

21.3 Charging Completed Motors to Factory Warehouse Stock

The red striped summary card in the tabulating control file always shows for each district office the total quantity of motors on hand at the beginning of a month. The number of motors on hand and the authorizations are punched in columns 20-22 and 23-25, respectively. When a motor is placed in finished stock in the factory warehouse, the salmon striped manila card and the manila inventory card, which have been addressographed with motor rating and gang punched from the master coding card in the factory, are used to record input into the warehouse. The warehouse files the manila card behind the corresponding motor number in its own file. The salmon striped card is sent to the Tabulating Department where it is used in

THE MERRILL CO.

preparing a weekly summary of input to factory warehouse. After this weekly report has been prepared, input cards are filed by motor number in the factory warehouse section of the tabulating file. This weekly report has the effect of the following journal entry:

Dr.	Factory Warehouse Inventory	) for cost of motors
Cr.	Work in Process Inventory	) manufactured.

21.4 Issuing Motors to District Offices from Requisitions

When a requisition is received in the factory warehouse from a district office, manila cards are pulled from the inventory file corresponding to the motors ordered. The factory memo of shipment number, the date of shipment number, and the code number of the warehouse to which the motor is to be shipped are punched in all cards pulled. The manila cards are then reproduced into new manila cards which are punched with the full information, including value. The original manila cards are sent by first class mail to the district warehouse. The reproduced cards are sent to the Tabulating Department where they are accumulated for preparing a weekly report of output from factory warehouse. Deliveries are frequently made from factory stock direct to customers. The weekly output report has the effect of the following journal entry:

Dr.	District Office Inventory	)for value of shipments
Cr.	Factory Warehouse Inventory	)to branch offices

Dr.	Cost of Sales	)for value of shipments
Cr.	Factory Warehouse Inventory	)direct to customers

21.5 Tabulating Card Control in District Offices

Upon receipt, the district office places the manila tabulating cards in an "In Transit" section of the file, pending the arrival of the motors. When the warehouse reports that the motors have been received, the cards are placed behind the proper index cards in the "On Hand" section of the file. When the motors are applied to a requisition, the cards are removed from the "On Hand" section and placed in the "Applied Section." At the same time, the general office reference number, date of shipment, customer code, industry,and user are entered on each card; if more than one motor is purchased by a customer, only the top card need be coded if all cards for motors purchased by the same customer are grouped with a rubber band or bill strap. Each of the tabulating cards pulled from a requisition is checked for "Count of Sales 1" in section E to indicate the number of motors sold in the requisition. As soon as the general office copy of the invoice to the customer is received, the corresponding cards in the "Applied" section are removed from the file and the values of the respective items are posted on the bill beside the proper extensions for each motor. This step assures crediting the district office inventory account with the same value for which it will be ultimately charged, illustrated by the entry,

Dr.	Cost of Sales	)for cost of
Cr.	District Office Inventory	)goods sold

The cards are filed then in the "Order" section from which they are pulled and reviewed weekly to determine whether

or not motors are to be replaced in stock, by entering an "X" in the "yes" or "no" space of section F. All manila cards pulled from the "Order" section are mailed to Denver in time to be received on Monday of each week.

Whenever transfers of stock are made between district offices, the shipping district removes the manila card from the "On Hand" section, inserts the general office reference number, marks replacement "yes" or "no" and enters "transferred out" in section D. Then one blank grey striped and one blank green striped card are written in ink, describing model number and motor rating, district office numbers involved, and specifying the value obtained from the manila card. The grey striped card is mailed at once to the district office receiving the motor. The manila and green striped cards are placed in the "Order" section of the file and mailed weekly with the cards representing sales. The manila card is a credit to the district office which shipped the motor and the green striped card is a charge to the district office which received it. The grey striped card in the file of the receiving district office serves as a manila card, signifying a motor received from some other source than manufacture. A somewhat similar practice is employed to regulate returns into branch office stock from customers, in which case a grey card placed in the "On Hand" section serves as a manila card and the green card sent to the home office charges the motor into district office stock.

21.6 Preparation of Weekly Reports from the Tabulating Control File

(a) When the Tabulating Department receives the manila and green striped cards each week from the district offices, the information entered by the districts is punched into the cards. A tabulation is made from each district office, indicating by motor number, the quantity of motors sold, the number wanted, and the value of the shipment as follows:

DISTRICT OFFICE SHIPMENT REPORT AND BUDGET REQUISITION

OFFICE-Boston WEEK OF DEC. 18,1937

MODEL	NO.	HP	RPM	VOLTS	PH	CY	BRG	CL	DO	SHIPTS	WANT	VALUE
5K	204A7	005	0900	224	3	6	S	GP	7	2	2	
5K	204A14	007	1200	224	3	6	S	GP	7	2	1	
5K	220A2	010	1800	224	3	6	S	GP	7	2	2	
5K	224A1	015	1800	224	3	6	S	GP	7	3	3	
			Total							40	37	90622

The "wanted" column becomes the district requisition, superseding prior standard authorizations. 40 motors were delivered by district office 7 and 37 motors were ordered for replacement. The value of $906.22 is the credit to district office inventory and is obtained from this report.

(b) From the salmon striped cards delivered to the Tabulating Department daily as motors are received into finished stock in the factory warehouse, a weekly report of input is computed, showing the number of motors of each rating and their value as follows:

DENVER INDUCTION MOTORS

DELIVERIES TO FINISHED STOCK WEEK OF DEC. 18, 1937

MODEL	NO.	HP	RPM	VOLTS	PH	CY	BRG	CL	DO	QUANTITY	VALUE
5K	254A61	030	3600	244	3	6	B	FC		4	
5K	326B75	150	1800	244	3	6	B	FC		2	
5K	204A28	007	1200	244	3	6	B	TE		3	
5K	204A81	010	1800	244	3	6	B	TI		7	
			Total							479	1778024

The total value of $17,780.24 is the amount charged to finished stock and credited to work in process. The manila and salmon striped cards and a crate tag are addressographed at the same time to start manufacturing and when sent to the shops represent an authorization to produce one motor. When the motor is finished and delivered into the factory warehouse, the cards are received in the warehouse for punching. The addressographed cards which accompany the motor are checked with the red striped master coding card to verify motor specifications. The cards are then gang punched from the master code card, perforating the complete description of the motor and the value. The copper base of the motor is also gang punched into each inventory card, establishing the copper differential for adjusting billing as the price of copper goes materially up or down. After the salmon striped cards have been used for tabulating the weekly input report, they are segregated and accumulated until the end of the month.

(c) From the reproduced detail cards and other cards for direct customer shipments received daily in the Tabulating Department a weekly tabulation of output from the factory warehouse is prepared, showing the quantity shipped for each motor unit and the total units and value of the factory output as follows:

DENVER INDUCTION MOTORS

SHIPMENTS FROM FACTORY WAREHOUSE WEEK OF DEC. 18, 1937

MODEL	NO.	HP	RPM	VOLTS	PH	CY	BRG	CL	DO	QUANTITY	VALUE
5K	204A286	010	1800	244	3	6	B	TE		2	
5K	204A290	015	1200	244	3	6	B	TE		15	
5K	224A309	010	1800	244	3	6	B	TE		3	
5K	202A844	005	1200	244	3	6	B	TI		1	
. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
			Total							1017	3125411

(d) The same reproduced cards are then tabulated by district office and by direct customer sales code showing the total number of units and the total value of the shipments to the various warehouses and direct to customers.

VALUE OF SHIPMENTS REPORT

WEEK ENDING DEC. 18, 1937

	D.O	QUANTITY	VALUE
Cleveland	17	4	19613
Chicago	21	21	66363
Minneapolis	26	4	13467
Jacksonville	29	2	6966
Philadelphia	44	53	232356
.....	....	.....	.....
Direct to Customers	99	45	191624
Total		1017	3125411

For shipments direct to customers a manila card is not reproduced, but a red striped card is used in the Tabulating Department to credit the factory warehouse. These cards are separated from the reproduced cards after running the output report by warehouse, and the reproduced cards are separated and accumulated until the end of the month.

21.7 MONTHLY REPORTS from the TABULATING CONTROL FILE

(a) At end of the month, the summary cards containing balance "On Hand" at the beginning of the month are grouped with the input salmon striped cards and the output manila reproduced cards to summarize the net activities of the month. The total quantity on hand at the end of the month is secured by subtracting the quantity issued in the reproduced and customer shipments cards from the sum of the quantities in the summary cards and all the manila cards representing input. The resulting quantity obtained by direct subtraction from the alphabetic tabulator represents the "On Hand" balance at

the end of the period. The report is arranged as follows, and while for sake of brevity only the motor model number is shown, it should be understood that the complete motor number appears in the report. A balance forwarding summary card is punched automatically with the preparation of the factory warehouse activity report.

DENVER INDUCTION MOTORS

DISTRICT OFFICE INVENTORY & ACTIVITY RECORD

Denver WAREHOUSE 5 WEEKS ENDING DEC. 31, 1937

					SALES				MONTH	TOTAL
					CUMULATIVE		PERIOD		LAST	DISBURSE-
DO	MODEL	NO	AUTH	ON HAND	QTY.	NO.	QTY.	NO.	SALE	MENTS
98	5K	326B2	50	43	8				11	30
98	5K	202A99	15	6	16	7	13	4	12	26
98	5K	204A90	4	2	10	6	7	4	12	10
98	5K	202A91	50	2	25	3	3	1	12	42
98	5K	204A198	65	72	8	3	1	1	12	46

. . . . . .

(b) Each month the reproduced cards representing input to the district warehouse and the manila sales cards signifying output from the district warehouse are grouped with the summary cards for the previous period. The sum of the "On Hand" balance in the summary card plus the sum of the reproduced cards less the sales cards provides the "On Hand" quantity at the end of the month. The tabulation appears as follows, again shortening the motor number:

DENVER INDUCTION MOTORS

DISTRICT OFFICE INVENTORY & ACTIVITY RECORD

Buffalo WAREHOUSE 5 WEEKS ENDING DEC. 31, 1937

					SALES				MONTH	
					CUMULATIVE		PERIOD		LAST	PERIOD
DO	MODEL	NO.	AUTH	ON HAND	QTY.	NO.	QTY.	NO.	SALE	ORDER
08	5K	225B29	10	10	1	1	1	1	12	1
08	5K	254B27	20	19	5	2	5	2	12	4
08	5K	284B60	10	10	2	1	2	1	12	2
08	5K	324A55	2	2	2	1	2	1	12	2

. . . . . .

Summary cards are punched when tabulating the district activity reports, punching all adding fields and balance forwarding the inventory "On Hand" at the end of the month.

(c) At the completion of the warehouse activity reports, the summary cards of all warehouses are assembled and a consolidated report showing the inventory and activity of the entire company is prepared by motor rating. Both the distribution manager and the district office managers receive their copies of the district warehouse activity reports. The distribution manager and the production manager receive copies of the total company activity report. Omitting as before, the lengthy description of motor rating, the summary report for the month is arranged as follows:

DENVER INDUCTION MOTORS

SUMMARY OF INVENTORY AND ACTIVITY 5 WEEKS ENDING DEC. 31, 1937

		AUTHORIZED			ON HAND			PERIOD SALES		
MODEL	NO.	FACT.	OTHER	TOTAL	FACT.	OTHER	TOTAL	FACT.	OTHER	TOTAL
5K	204A69	130	70	200	121	83	184	44	100	144
5K	204A2	500	211	711	615	227	842	160	200	360
5K	204A50	430	126	556	486	133	619	40	124	164
5K	224A2	390	124	514	538	126	664	344	152	496
5K	224A10	195	110	306	197	100	297	8	108	116

. . . . . .

21.8 Advantages of the Punched Card System

Excluding the losses incidental in the liquidation of obsolete stocks from the opening inventory, the punched card system of finished stock inventory control has saved the Merrill Company about $750,000 in the four year period ending December 31, 1937. The number of items and quantities of stock of each item carried in warehouses has been reduced materially and the stock turnover has been increased from 6-10 times to 10-14 times. About 40,000 salmon striped and reproduced cards are used in the Tabulating Department each month, a much smaller volume of transactions than had been necessary on the former manual basis. Prompt, accurate, and dependable detail records of the authorization and "On Hand" inventory of finished stock are furnished, both in units and in value. Complete and accurate information regarding sales activity, for the year to date and the current period, are provided, both in quantity and in value, for both factory and district warehouses. The manual preparation of statistics in the district office and accumulation at Denver is eliminated. The writing of requisitions in district offices is avoided. Weekly tabulated requisitions permit more accurate and more even flow of production and do away with most interim requisitions. The preparation and costing of memorandum of shipment is obviated at the factory. It is unnecessary to maintain records in the general office and district office on shipments charged and received into district office inventory accounts. The posting of stock records in the district office is discontinued. The insertion of the value of shipment on the general office

copy of the district billing makes it unnecessary for the general office to obtain costs from the general office bill from the factory.

The foregoing citations of advantages of the punched card system are statements made by the Cost Accountant of the Merrill Company.

22.0 Payroll Accounting at the F. H. Browning Company, Hazelton, Pennsylvania

22.1 Description of the Business

The F. H. Browning Company is a leading manufacturer of heating and ventilating apparatus, turbans, engines and vacuum cleaners. The company manufactures many of the parts used for its various products but must also purchase many items outside to permit assembly of complete units. While an appreciable share of all deliveries is made from standard stock, 75 per cent of sales volume is represented by special orders. Products of the Browning Company are marketed by a combination of direct selling and jobbing. The company employs 50 salesmen. Manufacturing plants are located at four points in the United States. Distribution is national in domestic coverage, and the concern possesses a small but growing foreign business.

All orders originate from specifications approved by the engineering department. Drawings must be accepted by customers before orders are written. Production costs are accumulated by the shop order plan of costing because of the lack of uniformity of finished product. The production department prepares its own schedule. Each production order is assigned a number by the planning department and is routed to the department which does the work. The complete order is broken up by sections for different apparatus operations, and the tabulating department receives its own copy of the subdivided order sections. When orders are received in the shops from the planning department, work begins. There is no

problem of idle time, for every worker is always supplied with more jobs than he can do in a day. This is accomplished by the cooperation of shop foremen, timekeepers, and roving "chasers." The function performed by chasers is to follow the progress of individual orders in the different apparatus sections to smooth the flow of production. The chasers make sure that materials are available when wanted, that lost time because of change in machine set-up is kept at a minimum, and that the progress made in individual apparatus sections upon a particular production order is commensurate with availability of a finished parts in the final assembly stage. The shops are divided into 75 productive departments and 10 service departments.

22.2 Use of a Punched Card System for Payroll Accounting

The necessity for exhaustive labor distributions because of the nature of the business makes the use of tabulating machines for payroll accounting indispensable to the F. H. Browning Company. The subdivision of production orders over many apparatus sections, the payment of workers on both a day rate and a piece rate basis, the accumulation of costs in 75 departments, and the large volume of factory expense accounts create a complex problem of classification, compilation, and analysis. The weekly payroll for 1100 employees is prepared from punched tabulating cards. A separate tabulating card is prepared for recording day or piece work time for every operation that a worker performs in every apparatus section upon a particular production order number. 2000 job

time cards are received in the tabulating department daily, of which 65 per cent represent piece work; 30 per cent, day work; and 5 per cent, factory expense. For purposes of control, the labor costs incurred in the shops are divided into three sections called "books," which helps to localize the variances that occur. The hours run from 7 A.M. to 4 P.M. for a 5 day week. Employees punch "In" and "Out" by registering time on a time sheet punched from an International Time Recording clock. Hours and minutes from 7 A.M. to 4 P.M. are registered by punching the digits from 0 to 8 to signify hours and tenths to indicate every six minute interval. 7:25 A.M. would be recorded as 0.4 and 3:48 P.M. would be indicated as 7.8. The elapsed time is figured by departmental timekeepers. A distinctive clock number identifies each employee by a numeric code number. No two employees in the whole plant have the same shop clock number. The tabulating basis for payroll accounting is usually resolved into accumulating in the basic punched cards the date, clock number, social security number, hours, rate, gross earnings, production order or standing order number, overhead application, department, account, tax amounts, and the net earnings. The method in use at the F. H. Browning Company is both an especially efficient and spectacular payroll application.

22.3 Description of Tabulating Card Forms Used

The following tabulating card forms are used by the F. H. Browning Company for payroll distribution and for production control:

Exhibit 21 -- Employee's Occupation Master Card
Exhibit 22 -- Labor and Factory Expense Distribution Detail Card
Exhibit 23 -- Payroll Summary Card
Exhibit 24 -- Addition or Deduction Detail Card
Exhibit 25 -- Employee's Weekly Payroll Receipt Card
Exhibit 26 -- Material Distribution Detail Card

The employee's occupation master card is sorted ahead of detail cards for corresponding clock numbers and governs punching of book, home department, occupation number, and registration number in the payroll summary card. It is also used to supply the hourly rate for group extending the earnings of those employees paid on a day work basis and for providing the percentages of tax deductions which determine the amounts for social security deductions by running payroll summary cards through the multiplier.

The labor and factory expense distribution detail card is the fundamental card for the punched card payroll system. It provides the basis both for determining employees weekly earnings through preparation of the payroll book and for distributing actual labor cost to work in process or to factory overhead. It also is the basis for applying factory overhead to work in process through the application of predetermined overhead rates for distributing departmental indirect labor and factory expense as a percentage of direct labor cost. The payroll detail card contains the vital classification fields of date, clock number, occupation number, home department, charge department, order number, and charge account.

Piece work is distinguished from day work by the punching of an X control position in column 80. The payroll

DEPT. CLOCK

Exhibit 21

EMPLOYEE'S OCCUPATION CARD

RATE | BOOK | OCCUP. | HOME DEPT. | CLOCK NO

RATE

BOOK

OCCUP NO

NAME

STREET ADDRESS

CITY AND STATE

MARRIED SINGLE

OCCUPATION NAME

REMARKS

I.B.M. 507536 LICENSED FOR USE UNDER PATENT 1,772,492 K. W. 6900 (3-25)

THE F. H. BROWNING CO.

ORDER NO | DATE | EMPLOYEE'S NAME

Exhibit 22

Dual Labor & Expense Distribution Detail Card

HOME DEPT | ACCOUNT CHARGED | PART NAME

CLOCK NO. | DEPT CHARGED

CLASS

DRAWING NO.

ITEM NO | PATTERN NO.

NUMBER OF PIECES

OPER. NO | PRICE PER 100 | PRICE EACH

SET UP NO. | PRICE PER S.U | VALUE

	PIECE WORK	DAY WORK	OPERATION
FINISH			
START			
ELAPSED TIME			
RATE PER HOUR			
VALUE			REASON FOR DAY WORK
IND LABOR			
FACT. EXP.			
TOTAL			

DATE MO.	DAY	HOME DEPT	CLOCK NO.	ORDER NO	CLASS	DRAWING NO.	ITEM	CHARGE ACCOUNT	CHG DEPT.	HRS	LABOR	IND LABOR	FACT EXP	TOTAL

LICENSED FOR USE UNDER PATENT 1,772,492 I.B.M. 23048

THE F. H. BROWNING CO.

Exhibit 23

Payroll Summary Card

DATE MO	DA	YR	BOOK	HOME DEPT	CLOCK NO	OCCUP.	PIECE WORK HRS	PIECE WORK AMOUNT	DAY WORK HRS	DAY WORK AMOUNT	ADD	DED	GROSS PAY	REGISTRATION NUMBER	SOCIAL SECURITY DEDUCTIONS OLD AGE	SOCIAL SECURITY DEDUCTIONS UNEMP	NET AFTER TAX	LOST TIME	

DUPLICATE — SUMMARY PUNCH

LICENSED FOR USE UNDER PATENT 1,772,492

THE F. H. BROWNING CO.

Exhibit 24

ADDITION OR DEDUCTION CARD

ADD. | DED. | DATE MO. DA. | HOME DEPT. | CLOCK NO. | OS. ADD. OR DED. COMP

THE F. H. BROWNING CO.

I.B.M. 507536 LICENSED FOR USE UNDER PATENT 1,772,492 K. W. 6900 (3-25)

Exhibit 25

YEAR 1937

PAYROLL RECORD

DATE	CLOCK NO.	GROSS AMT.	DEDUCTIONS		NET AMT.
			OLD AGE	UNEMPLOYMENT	

THE F. H. BROWNING CO.

I.B.M. 531920

Exhibit 26

ORDER NO.

MATERIAL REQUISITION

DATE

MATERIAL CENTER

CLASS

DRAWING NO

ITEM NO.

CHARGE ACCOUNT

CHARGE DEPT

NO. PCS.	WEIGHT	PRICE			DESCRIPTION AND PATTERN
			L	IND. LAB	
			M	FACT. EXP	
			L	IND. LAB	
			M	FACT. EXP	
			L	IND. LAB.	
			M	FACT. EXP	
			L	IND. LAB.	
			M	FACT. EXP	

FOREMAN'S SIGNATURE

DATE MO. DA.	MAT. CEN.	ORDER NO.	CLASS	DRAWING NO.	ITEM	CHARGE ACCOUNT	CHG. DEPT	LABOR	MATERIAL	INDIRECT LABOR	FACTORY EXPENSE	TOTAL

THE F. H. BROWNING CO.

LICENSED FOR USE UNDER PATENT 1,772,492 IBM 523649

summary card has classification fields for date, book, home department, clock number, occupation number, and social security number. A master rate card is used for applying burden at predetermined rates into detail cards as a percentage of direct labor cost. Overhead rate cards are established for each department which are sorted ahead of corresponding departmental detail cards prior to extending the overhead application in the multiplying punch. Each departmental overhead rate card contains two rates, one for applying indirect labor and the other for applying factory expense. The addition or deduction card is used for adjusting short or excess weekly wage payment through the labor field of the payroll detail card.

The materials distribution card is used to distribute the cost of direct materials and supplies issued to work in process; indirect materials are charged to factory overhead. The production order number and the standing order number are the means of differing between direct and indirect materials cost. The adding fields of the materials card are aligned exactly with the adding fields of the labor and applied overhead card. This alignment is necessary so that a single tabulation of cards for completed orders pulled from the work in process file will furnish the cost of goods manufactured.

22.4 Flow of Work and Establishment of Payroll Control

Orders are routed to the shops by the planning department. The timekeepers of each department issue dual tabulating cards to workmen daily which serve both for purposes

of originating a shop record to describe the work to be done and to pay individual workers for the operations which they perform. An individual employee will receive several job cards at one time and will be directed by the shop foreman, in accordance with routing by the planning department as to the sequence of work upon the individual orders or operations. The foremen see to it that materials are provided when needed. Order chasers circulate throughout the plant to follow the progress of production in an effort to maintain steadiness and balance among the different operations of individual production orders. Special care is devoted to completion of shop orders in desired preference. Whenever workers are delayed or stopped in performing specific operations, immediate steps are taken to remedy the difficulty.

The departmental timekeepers receive time cards for individual workmen as soon as specific operations are completed. They note the accuracy of the start and stop time and verify the completeness of the descriptive data on the dual card. Cards for day work are unpunched in X-80, inasmuch as rates are applied to day work from master cards and extension of earnings for these cards is obtained from the multiplier. Cards for piece work are punched X-80 for sorting convenience in the tabulating room. Piece work cards are completely figured by the timekeepers and are not extended in the multiplier, because of the existence of thousands of piece work rates.[88] The time keeper figures elapsed time on all cards and separates the completed cards into the three different groups of day work, piece work, and factory expense.

88 Conference with E. Betz, I.B.M. salesman. Workers have different rates for distinct piece work operations. Rates must be separately applied.

All cards for piece work are priced by reference to a master rate file, and the piece work earnings are extended and entered on the tabulating card. All the tabulating cards for the day are sent to the tabulating department, accompanied by a clock tape of the day's time. The timekeeper figures the elapsed time of each workman from the recordings of "In" and "Out" time as registered by the time clock and foots the elapsed time to a total for each department.

When received in the tabulating room, the cards for the different shops are kept separate by three control divisions called books. A daily trial balance of time is taken to check the distribution of time obtained from the tabulating cards against the totals established from the clock tapes. Variances between the two totals are reconciled if the differences were caused by computation or punching, and short time is punched as time lost with classification of the reason.

The day work cards are passed directly to the punch operators who punch the fields for date, clock number, home department, order number, hours, and charge department. The day work punching is proven by repeat punching in the verifier. When punching is completed, the day work cards are sorted by order number and released to boys who check the order number and the apparatus number from their copy of the production order to verify that the completed work of individual operations agrees with the specifications of the order. This important checking step ensures that all work required for each operation has been finished and that the right apparatus was used for the work.

Meanwhile expense cards have been classified according to the account to be charged, and these cards are separated into day work and piece work and punched accordingly. The piece work cards represent 65 per cent of the entire card volume, and are punched and verified following the punching of day work. In punching piece work, the punch operators must perforate the piece work rate and the gross earnings amount, in addition to the fields punched for day work. Piece work cards are sorted by order number and released to boys for checking from their copies of production orders. The checking clerks verify the pricing of the piece work from their files of piece work rates, prove the earnings extension for piece work, and check the correctness of work done against specifications. On the reverse side of the order the clerks post the number of pieces finished, the unit price per piece, the employees clock number, and the date. Differences revealed by the checking operation are reconciled.

Master occupation cards for each employee are next sorted ahead of the detail cards for the entire day. This step prepares the cards for the extension of day work by the multiplier. By use of a card matching device in the sorter, the inactive master cards for employees who have no detail cards for a particular day will reject. Besides containing clock number, occupation code, and home department, the master records also contain day work rate, the one per cent tax rate used for computing social security tax deductions, and the social security registration number. A trial balance is then run for each department which tabulates clock number, rate per hour, and total hours. The total hours for each

department are verified against the totals from the departmental clock tapes to prove elapsed time. Since employees always punch "In" and "Out" in their home departments, the trial balance is prepared by home department to reconcile variations for the particular day caused by employees who do work in any charge department other than their own. The trial balance also verifies that the master rate card is ahead of the corresponding detail cards which it represents.

All cards are now sorted on column 80 to separate the day work (no-X 80) from the piece work (X-80). Day work cards are run through the multiplier and the day work rate is extended and punched in the day work field, by wiring the machine to extend the day work rate times the one per cent tax rate. The cards are again run through the multiplier to compute and punch day work gross earnings by multiplying day work hours times the rate. The multiplying punch of the F. H. Browning Company is used on nearly a full time basis, so some of the checking which normally is obtained by a secondary check run through the machine is performed by a calculator. Following the day work extension, the master cards are sorted out, the detail cards are sorted by rate, and a tabulation is prepared controlling by rate, showing hours and amount. The extensions registered in this tabulation are verified by calculator to prove with the control total obtained from the visible products counter of the multiplier.

Incidentally, the piece work rates of the F. H. Browning Company were established in 1929. Since they were found to be too low in subsequent use, all the piece work

earnings, which temporarily were punched in columns 10-15, are adjusted by running the piece work cards through the multiplier. The earnings manually figured by the timekeeper from use of the 1929 rates are converted to a present day level by using 110 per cent as a fixed multiplier to compute current weekly wages and to punch the earnings in the labor field, columns 56-61. The flexibility of punched cards and another evidence of the spectacular payroll method of the F. H. Browning Company are illustrated in this adjustment process. The weekly wages of 750 men paid on a piece work basis could be revised at any future date with no other change in system than to punch two or three holes in one master card to provide a new fixed multiplier for adjusting the 1929 basis. The adjusted piece work cards are tabulated by rate and proven by calculator like the day work. About 2500 labor cards are received by the tabulating department daily.

Factory overhead is applied to jobs daily by extending burden, at predetermined rates for each department, as a percentage of direct labor cost. The multiplying key punch is used for applying factory overhead. Burden master rate cards are established for each department which contain two prepunched fields representing the percentages for applying indirect labor and factory expense. An individual burden rate card might use 50 per cent for applying indirect labor and 15 per cent for absorbing factory expense, both extended as a percentage of direct labor cost. The burden master rate cards are sorted ahead of the day's direct labor detail cards by department. There are 75 productive departments

and 10 service departments in the shops. The visible products counter of the multiplier has 10 positions, so it is possible to obtain both burden extensions from one run of cards by splitting the products counter into two sections of five digits each. The direct labor cost is the multiplicand, which is obtained from the direct labor cost in the detail card, and the burden rate card, containing two application percentages, is the multiplier. All master cards having burden rates over 100 per cent and all detail cards over $10.00 in direct labor cost must be sorted out and run through the multiplier twice to secure separate burden extensions for indirect labor and factory expense, since the split counter does not have sufficient carryover capacity to permit both extensions from a single run. As a result of the departmental burden application to direct labor cards in the multiplying punch, each individual tabulating card in the stacker of the multiplier contains the clock number, the order number, the direct labor cost, the applied indirect labor burden, and the applied factory expense burden. It may be now stated that all elements of cost of goods manufactured are obtained from tabulating cards in an effective system of production control. The manner in which the elements of cost are accumulated by a punched tabulating card file for work in process, set up by production order number, will be discussed later.

Before filing cards away for accumulation until the end of the week, a daily tabulation is run by book by department, day work and piece work separately, which serves as a control sheet in the tabulating department.

22.5 Preparation of the Weekly Payroll Sheet

At the end of each five day week, about 12,000 tabulating cards have accumulated from which the weekly payroll of 1100 factory employees is prepared. The master occupation cards are sorted ahead of detail cards by department, by clock number and because of the card matching device in the sorter, master cards are used with detail cards at this point in order to punch the payroll book and social security numbers into summary cards which are punched from running the weekly payroll trial balance. The weekly trial balance shows, in addition to the classification data identifying the employee, the piece work hours and money, the day work hours and money, the addition or deduction amount from adjustment cards for the previous weeks over and under payments, and the gross amount earned.

An interruption must be made here to explain the effective procedure for controlling the plus and minus corrections necessary for adjusting errors in the previous week's payroll. An authorized correction sheet is received in the tabulating department each week from which cards are punched which reconcile additions and deductions through the gross earnings field, columns 56-61. There are two problems in the adjusting,--to reimburse the worker for short pay or credit his earnings in the current payroll for any excess amount received, and to adjust current earnings for determining the correct base on which to figure social security tax deductions. If a worker was underpaid, a demand notice upon the cashier is given to the employee as soon as the

error is discovered so that he may secure the money. If an employee was overpaid, his account is credited in the current payroll by punching the correct complement for the amount overpaid in the earnings field. The gross earnings field as tabulated in the payroll trial balance contains the amount eligible for social security tax deduction. The addition cards, representing short pay of the week before, add to current earnings to summate the gross amount on which tax is due. The deduction cards, signifying excessive payment of the week before upon which the tax deductions were made at the time, subtract from current earnings to provide both the net amount due to the employee and the eligible base for figuring the taxes. In order that the effect of these adjustment cards may be clearly discerned, the payroll sheet has separate columns which show additions, deductions, and earnings after adjustment.

The summary cards which are prepared when tabulating the weekly payroll trial balance are run for total to prove the trial balance with control. This proof consists of establishing that the payroll totals of each book agree with the totals established by adding the day work and piece work earnings of the daily control sheets, plus additions and less deductions. It is especially noteworthy that whereas none of the detail cards of the payroll are punched with social security number and although the social security number does not show on the weekly payroll sheet, the registration number is punched in the payroll summary card, from which source it is available for identifying employees when making quarterly

reports of tax deductions of individuals for federal old age benefit and state umemployment insurance.

The weekly payroll summary cards contain the following punched information:

Card Columns	Card Field
1-6	Date
7	Payroll Book
6-10	Home Department
11-14	Clock Number
15-16	Occupation Number
17-20	Piece Work Hours
21-24	Piece Work Amount
26-29	Day Work Hours
30-34	Day Work Amount
35-38	Addition Amount
39-42	Deduction Amount
43-48	Gross Earnings
49-57	Registration Number
58-60	Federal Old Age Benefit Tax
61-63	State Unemployment Insurance Tax
64-68	Net Earnings After Tax
69-72	Lost Time

Master occupation cards which contain the social security tax rates are sorted ahead of the summary cards by clock number and home department. The cards of employees who are over 65 are sorted out, as these employees are exempt from federal old age benefit tax. Likewise, employees are exempt from federal tax after they have been taxed on the first $3,000 earned in a year and from Massachusetts unemployment insurance tax after the first $1,250 is earned in each six months period.[89] The cards for these exceptions must be segregated before extending both tax deductions fields in the multiplying punch. The total earnings in the summary card is the multiplicand and the tax rate in the master card is the multiplier. Both taxes are computed and punched in the tax fields in one run of the summary cards. The cards are then run through the multiplier again to cross subtract

89 Statement of V. Learson, I.B.M. Salesman

the sum of the two tax deductions from the gross earnings to compute and punch net pay. The weekly payroll sheets are then prepared by listing the summary cards by clock number and department in accordance with the following print bank arrangement:

Print Bank	Card Fields	Card Columns	Impression
List Bank 1	Piece Work Hrs. & Amt.	17-20x21-25	25x2476
List Bank 2	Day Work Hrs. & Amt.	26-29x30-34	14x1400
Counter 3	Addition or Deduction	35-38x39-42	100x0000
Counter 4	Gross Earnings	43x48	3976
Counter 5	Fed. & State Taxes	58-60x61-63	40x040
Counter 6	Net Earnings	64x68	3896
Counter 7	Dept. & Clock No.	8-10x11-14	132x1256

The weekly payroll sheet is illustrated in the appendix by report 12. The completed payroll sheets are released to the paymaster where the payroll is denominated and a voucher check is drawn for the signature of the treasurer. When the cash is obtained from the bank, each employee's envelope is prepared. Meanwhile, the full payroll receipt card is printed showing the date, clock number, gross earnings, tax deductions, and net earnings. The payment receipt cards indicate to the employees the amounts their envelopes should contain, when distributed with envelopes on pay day. The receipt cards also provide a basis to the employee for keeping a record of his tax deductions. The payment of the payroll is accounted for by the journal entry:

Dr.	Payroll Accrued	-- for amount paid
Cr.	Cash	-- for net amount paid
Cr.	Tax Liability Account	-- for tax accounts withheld

22.6 Weekly Payroll Distribution

All the tabulating cards of the week are now sorted and tabulated in a weekly distribution sent to the factory

superintendent which shows by department the piece work hours and amount, the day work hours and amount, and the total amount earned. These reports are used by the factory superintendent to provide the basis for comparing actual cumulative cost with corresponding budget estimates and comparative figures of the previous year. The reports indicate the departments which are responsible for any appreciable changes in comparison with the budget and enable the factory superintendent to investigate labor costs in those departments which are out of line. The labor cost is related to the cost of goods manufactured at the end of the month to determine the comparison between actual and expected results.

The second weekly report prepared from the detail cards determines the crediting of payroll accrued for total wages earned by factory department, in accordance with the journal entry.

Dr.	Direct Labor	-- for value charged to production orders
Dr.	Indirect Labor	-- for value charged to standing orders
Cr.	Payroll Accrued	-- for value of wages earned

The tabulating cards representing additional pay allowances on piece work jobs are then run by department, indicating the reason for the additional time, the amount earned by each employee, and the department total. Some of the reasons reported are bad tools, hard material, inexperienced operators, and repair delay. This report is especially valuable for it serves to check the general efficiency of the shops during the current period of completing production orders. Faults are investigated to determine what action has been taken; if nothing has been done to eliminate the

unfavorable conditions, the troubles are rectified wherever possible.

Another weekly distribution is made from direct labor cards to provide an analysis of direct labor hours and cost by factory account number. A similar breakdown is made of the indirect labor cost by factory account number.

Two weekly reports are prepared to classify direct labor on plant assets. The first of these reports distributes the cost by factory department and the second analyzes the cost by factory account number.

The direct labor cards for the entire week are sorted with direct material cards for the week by productive department and a cost report is prepared, charging work in process with the accumulated costs incurred, in accordance with the entries:

Dr.	Work in Process	--with all cost of production orders
Cr.	Direct Labor	--with direct labor cost
Cr.	Materials and Supplies	--with direct materials issued
Cr.	Factory Overhead Applied	-with indirect labor absorbed
Cr.	Factory Overhead Applied	-with factory expense absorbed

The direct labor and direct materials cards are sorted together by production order number and are filed in the work in process file behind tab cards which are indexed with the production order number. It should be noted especially at this point that all manufacturing charges for the week have now been accumulated in the tabulating cards. The direct labor cards contain, in addition to direct labor cost, the absorbed factory burden for indirect labor and factory expense applied. The three elements of production cost are

charged to jobs in the F. H. Browning Company in a most efficient manner, demonstrating once again the adaptability of the punched card method. The cost ledger is a file of tabulating cards. In fact, most of the structure of the plant accounting system is controlled by the punched card method.

The tabulating cards for indirect labor and indirect material are accumulated until the end of the month when they are tabulated by productive department to charge the actual factory overhead incurred.

22.7 Determination of Cost of Goods Manufactured

The tabulating department is informed by daily reports from the finished goods and finished parts warehouses when individual production orders have been finished. The cards for an individual order are pulled from the work in process file and are costed by tabulating the total value on the reverse side of the production order. The quantity specifications of the order are checked for final verification with the portions of the work produced in the different apparatus sections to ensure that the tabulated cost represents the entire cost of the correctly completed order. The costed order is filed in a pending file, from which it is pulled for billing on the shipping date. Inasmuch as most of the business of the F. H. Browning Company is special order bulk machinery, the cost value of the finished products must be known often in order that the customer may billed on a cost plus basis. Certain standard articles are billed in accordance with list prices quoted when the order is taken. The tabulating cards pulled from the work in process file represent cost of goods manufactured, and are held in a

transfer file to be tabulated monthly. Since most of the production of the F. H. Browning Company is shipped as soon as completed, the accounting for most of the cards pulled from the work in process file is as follows:

Dr.	Cost of Sales Accounts	-- charge to sponsor depts.
Cr.	Work in Process	-- cost of goods manufactured

In order that the tabulating room may know how to charge the cards pulled from the work in process file, the billing department provides a copy of all company invoices specifying whether the shipment is complete or partial. The balance of cards pulled from the work in process file which have not been charged to departmental cost of sales accounts at the end of the month by reference to company billing represents the unshipped finished orders on hand. These unshipped finished orders are tabulated separately at the end of the period and produce the accounting entry,

Dr.	Finished Stock Inventory	-- for value on hand
Cr.	Work in Process Inventory	-- for cost of goods manufactured

The entire work in process inventory file is tabulated quarterly for check with the Work in Process controlling account in the general ledger.

22.8 Summary

In the foregoing outline of punched card activity in the F. H. Browning Company, a typical case of comprehensive manufacturing application has been presented. A full appreciation of the flexibility of punched card accounting may be gathered from this installation. Attention is particularly called to the repeated use of the punched data in the tabulating card for different purposes. The labor cards provide

the basis for the payroll book, the labor distributions, the application of factory overhead, the charging of work in process for direct labor, the charging of factory overhead for indirect labor, and the ultimate debiting of finished goods inventory and cost of sales for direct labor. Under a manual system each controlling account must be supported by separate subsidiary detail. The Work in Process account is regulated by detailed manually compiled cost sheets. In the F. H. Browning Company, for example, the manual cost work of the job order system would be much involved because of the division of the individual orders among several different apparatus sections. Any job order system requires a vast amount of clerical work, not only from the point of view of costing the individual orders but also from the requirements for exhaustive columnar work sheets to post departmental expense and classify items of factory expense for accounting records. The main points of excellence in the punched card method are the elimination of the independent and different original records necessary every step of the way under a manual process; the substitution of fast and accurate machine operation for most production clerical routine instead of slow, complicated, and less accurate human labor; and the overall considerable saving in cost of operation. It is evident from the Browning case as well that by using tabulating cards for labor and material distribution, the company secures a system of production control as a by-product of the direct application of tabulating machines for controlling payroll accrued and materials and supplies inventory.

Tabulating cards are not used in the Browning Company to accumulate actual monthly costs for expense distribution and fixed charges. The tabulating routine does, however, provide the actual factory overhead charges for indirect labor and indirect material. The factory overhead applied is compared monthly with actual factory overhead incurred to determine which departments are out of line. Overhead over or under applied is carried from month to month as a deferred credit or deferred charge. At the end of the year the amount of variance in applied burden against actual overhead incurred is adjusted in the cost of sales account.

23.0 The Ideal Use of Tabulating Machines for Inventory Control by the Overland Chain Grocery Company, Minneapolis, Minnesota.

23.1 Description of the Business

The Overland Chain Grocery Company operates 3300 retail grocery stores in six west central states, controlled from one main distributing plant located at Minneapolis, Minnesota. The company handles several thousand different units of grocery, bakery, produce, and meat items, measured in terms of the different standard packing units in which individual commodities may be supplied. The average weekly sales volume of an individual chain store is $1000.00. There are certain items which all stores must carry in stock, and other optional items which managers may carry in accordance with the class of neighborhood which they supply. The 3300 stores are divided into numerous merchandising divisions, which are controlled by traveling supervisors. Individual stores receive deliveries ranging from a weekly to a daily basis, depending upon the size of the store, the location, and the kind of commodity delivered. The warehouse distributes to all stores by company owned trucks. Store requisitions are filled on a staggered delivery basis in order to spread the work of physical handling, office routine, and transportation service on an equitable basis.

Because of the vast number of retail outlets, the variety of items carried by each store, the frequency of replenishing stocks, the physical handling of goods, and the terrific burden of office routine, the chain store business represents

a most complex industry. The volume of transaction is enormous. Most large grocery chains in the United States to-day use the Davidson system of punched card accounting to control their distribution, usually by employing Powers tabulating machines.[90] When it is realized that volume merchandising is based upon small unit profit, it immediately follows that the chain store grocery system would be limited in expansion without some economical means of central and efficient control which permits the distributing cost to be absorbed. In fact, if punched card systems had not been employed by large grocery chains they could never have developed into the gigantic enterprises which we find to-day.

The major functions in the business are described as follows:[91] " Buyers purchase goods for warehouse delivery. The warehouse receives the goods and stores them as surplus merchandise, available for selection. The individual stores send orders for goods to the warehouse. The warehouse selects, packs, assembles, and delivers the merchandise to the stores. The office costs, prices, and bills the goods to the stores. The purchasing department maintains purchase and stock records. The office also audits the store accounts and prepares sales statistics which the management must have instantly."

23.2 Arrangement of the Prepunched Inventory File

Why may a chain grocery punched card system be considered the ideal application? The answer is found in the standardization of packing units for individual commodities which permits the origin of a completely punched and extended

90,91 Grocery Chains - Powers Bulletin, Page 3

tabulating card for each unit, providing all data for controlling purchase, shipping, warehouse and store inventory, billing, costing of sales, and regulation of retail outlets. The first step in beginning the system is to adopt a four digit numeric code which identifies each article handled by commodity number. Each individual item is identified in the inventory card by alphabetic punching of the item name and the shipping unit, but the items are also punched with commodity number in the selection field to facilitate setting up the inventory file, placing and filling of store requisitions, and machine sorting in the tabulating department. Identification cards for warehouse floor, and section bin locations are punched and filed in the inventory file to identify where merchandise may be found when store requisitions are filled from store billing. The arrangement of stock in the warehouse sections, the display of merchandise upon the shelves of the retail outlets, the numerical filing sequence of inventory cards in the tabulating department, and the appearance of items on store requisitions all follow directly the same numeric order. This predetermined uniform numeric sequence of performing all the distribution functions is the basis of the extreme success of the punched card plan.

Whenever a shipment of merchandise is received in warehouse stock from purchase order, a copy of the receiving report is sent to the tabulating department. Let us suppose that 5000 cases of Golden Bantam Corn, packed 24 tins to a case had been delivered into stock. The 5000 cases received are

entered on a master control card which is maintained to govern the activity of each commodity. The control card is a dual card, containing written information and certain punched data and is used to originate the prepunched inventory file. The control card shows date of receipt, source of entry, number of original cases, number of shipping units, serial number assignment, retail price and shipping unit sales extension, cost price and shipping unit cost extension, commodity name, commodity number, weight and department of location. From the master control card for Golden Bantam Corn, 5000 inventory cards are gang punched or reproduced and are serially numbered in the process from 1 to 5000. The serial number impression is obtained from an automatic numbering stamp attached to the punch, which stamps the cards in consecutive numeric sequence and identifies commodity number in the form 1587-6938. A Powers 90 column tabulating card is used to record the punched inventory data. In the inventory detail card the complete alphabetic description is punched, as well as the size and contents to refine the packing unit. The commodity number, commodity name, weight and location, and packing unit are gang punched from the control card. The selling price, sales extension and cost extension are manually punched in a set-up card. Prior to running the inventory cards for the lot, the punch operator must sight check the first card punched from the master control card to verify in a positive check that the data in the detail card is correct. After verification, the exact quantity of serially numbered inventory cards is gang punched to agree

with the assignment of numbers on the control card. The inventory detail cards are filed behind corresponding tab cards, indexed for clear visibility with the commodity number. The filed inventory cards contain all data needed to produce finished store invoices except the shipping date, store identity and possible revision of the selling price.

The individual tub file is divided into 14 sections. Tubs are built waist high and are arranged in numeric sequence of commodity number in order that clerks pulling cards from requisitions may work freely in standing posture without colliding and with no necessity for taking wasted steps. The pulling clerk is always working forward in gathering the cards ordered and is not confronted with a problem of skipping back and forth to find desired cards. When the requisition has been circulated once throughout the tub files, always in a forward motion, all the inventory cards will have been pulled when the last tub has been covered. Location cards are inserted wherever the department changes. Group indication cards are stacked ahead of detail cards when more than one unit is requisitioned; these group indication cards are necessary in order to ensure the printing of the entire quantity and value of an individual commodity on the same horizontal line of billing. A prepunched first total card is stacked behind the pulled inventory cards for each commodity, causing the tabulator to print and clear its sectors automatically after each commodity cycle. A prepunched section total card is stacked at the end of each warehouse group to provide a sub-total for

each warehouse section. A grand total device on the tabulator accumulates the entire total for the entire bill. Three degrees of totals are hence determined from only one run of cards.

Inventory cards for an individual commodity in the tub file are set up in a particular manner. The index tab card appears first, identifying the commodity number. Since cards are always pulled from the back of the section the sequence of serially numbered cards always runs from lowest to highest number; every card pulled must be the lowest serial number in the section. A minimum card is stationed in the file at the proper ordering point for each commodity. As these minimum cards are uncovered in the daily course of pulling they are segregated for tabulating a daily report which notifies the purchasing agent to purchase additional merchandise. Further along in the file toward the depletion point, a danger signal card is placed, which, unless stock has been replenished as a result of the minimum report, is pulled for rush follow up by the purchasing department. If stock actually becomes exhausted, " Out " cards are pulled either to notify the the stores that the main warehouse is temporarily out of stock awaiting completion of purchase orders or that the number is dropped from the line. A reserve filing section is maintained for storing temporarily large quantities of inventory cards for volume items which turn over fast. The reserve lot is indicated in the inventory file by a reserve card in back of the minimum card. This provision simplifies the work of boys who pull cards greatly, since it speeds the pulling operation by

lessening to a practical minimum the number of steps which they have to take in completing the work.

Special attention must be called to the use of change in unit cards and master price change cards. Certain articles like sugar, coffee, and spices are purchased in one unit and repackaged for shipment in smaller units. Inventory control is established only on the bulk quantities purchased. A change in unit card in the inventory file signifies that the cards for bulk units representing the original purchase before repacking should not be pulled to fill requisitions. Prices and extension values are normally not punched in the master control card because of change in level of market prices. Price change cards are punched from daily price change bulletins which authorize the correction of the current day's invoices and the inventory cards on hand for sales price and selling value of the items affected. The bills are corrected manually and the inventory detail cards in the file are removed and adjusted by gang punching from the price change card in a new zone. A posting is made to the control card, noting the serial number range in which the price and value was adjusted.

23.3 Discussion of Card Forms Used

The entire system of control hinges upon the prepunched and denominated inventory control file. The essence of the system has already been briefly outlined but attention is now directed to an examination of some of the card forms used in accordance with the following exhibits:

Exhibit 27 - Manila inventory card - grocery division
Exhibit 28 - Brown striped inventory card - produce division
Exhibit 29 - Solid brown inventory card - bakery division
Exhibit 30 - Solid orange card - store name and address
Exhibit 31 - Red striped buff card - first total
Exhibit 32 - Green striped buff card - section total

Different colors of tabulating cards are used to identify major classes of commodities. A plain manila 90 column card, for example, is used for the grocery division. The physical routine for arranging the inventory file has already been described. The punched manila detail card, proceeding from column 1 to column 90 contains fields for commodity name, zones for selling price and sales amount, cost, weight, commodity number, packing unit, size, and price revision fields. Attention is called to the division of the Powers tabulating card in the middle horizontally to provide two sections of 45 columns each. The Powers 90 column punch is devised to transcribe into the upper or the lower half of the tabulating card from two separate keyboards, respectively. In an individual six position card column, the odd digits from 1 to 9 are recorded by a single punched hole in a position; the even digits from 0-8 are punched by the double punching of a sixth position in combination with one of the other positions. Similarly, a limited alphabet containing 19 significant letters is punched in a single six position card column. The letters from A through L are represented by single or double punching of the six position, and the letters from M to Z are indicated by double or triple punching of the six positions. When triple punching, the punching of the first position identifies selection of the

Exhibit 27 — Grocery Division

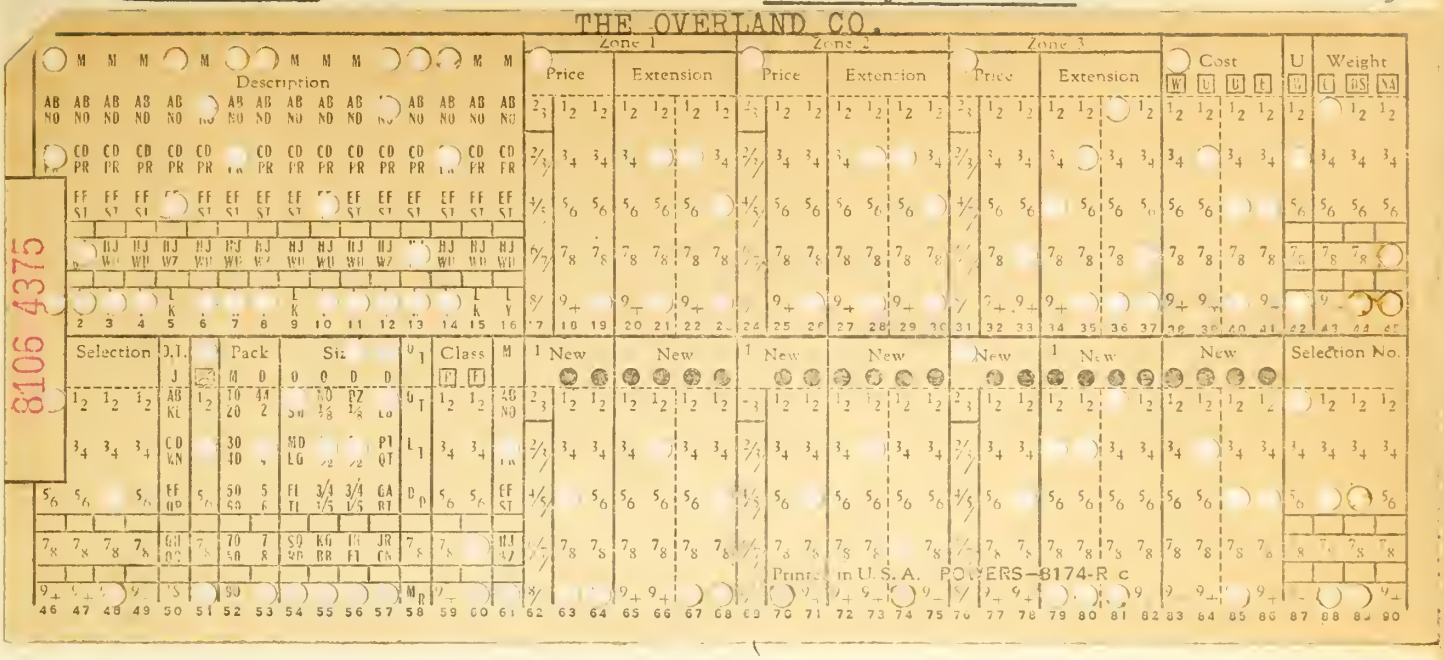

Exhibit 28 — Produce Division

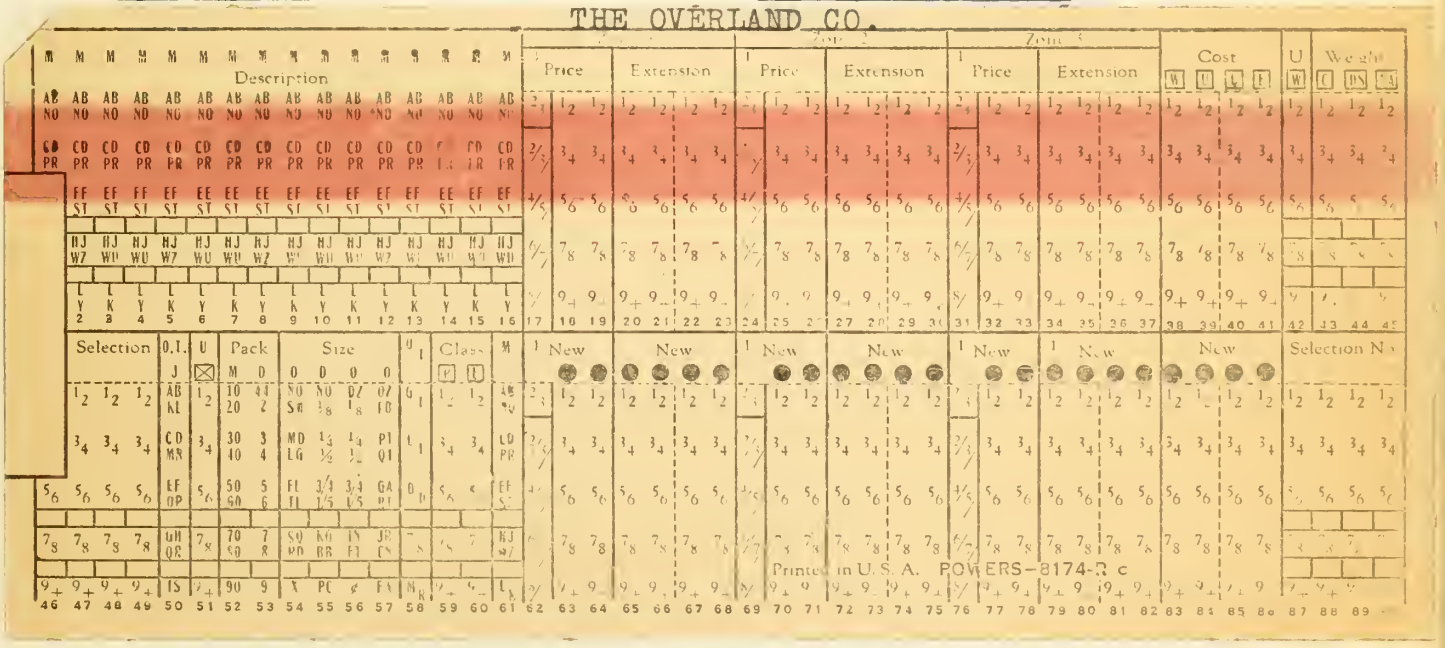

Exhibit 29 — Bakery Division

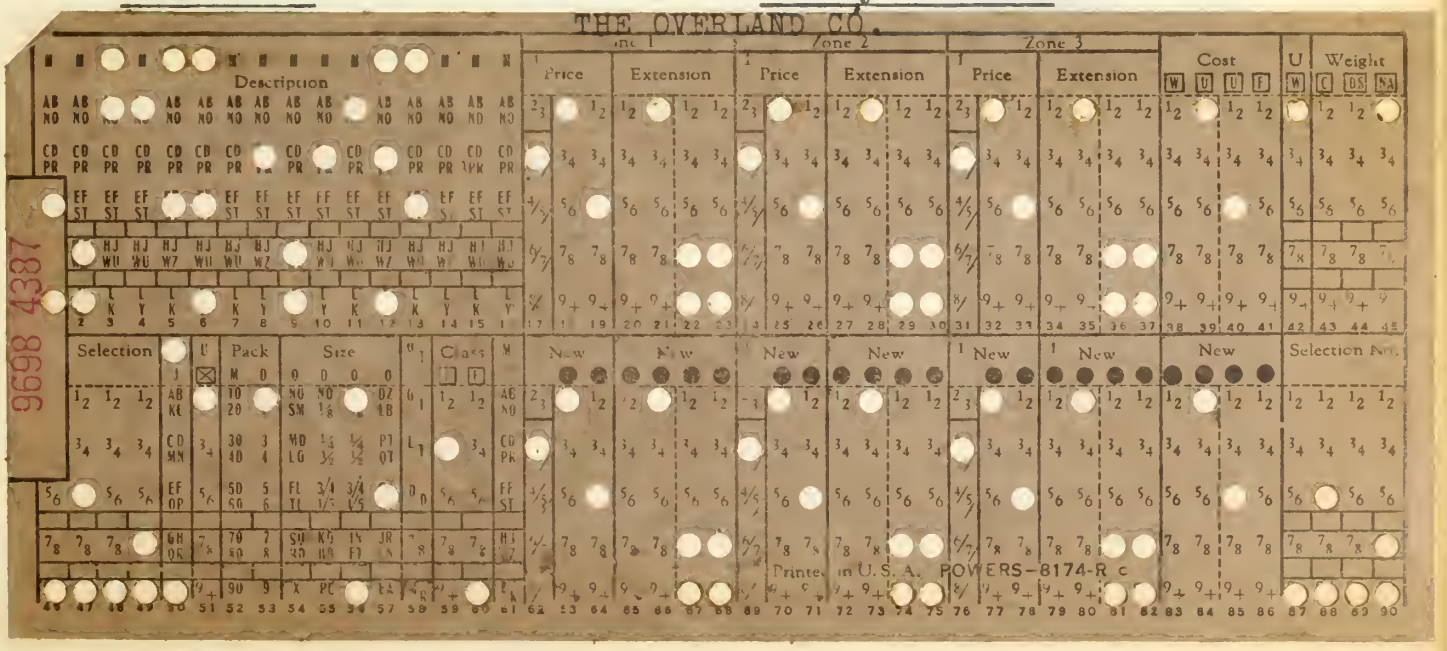

Exhibit 30 Name and Address Card

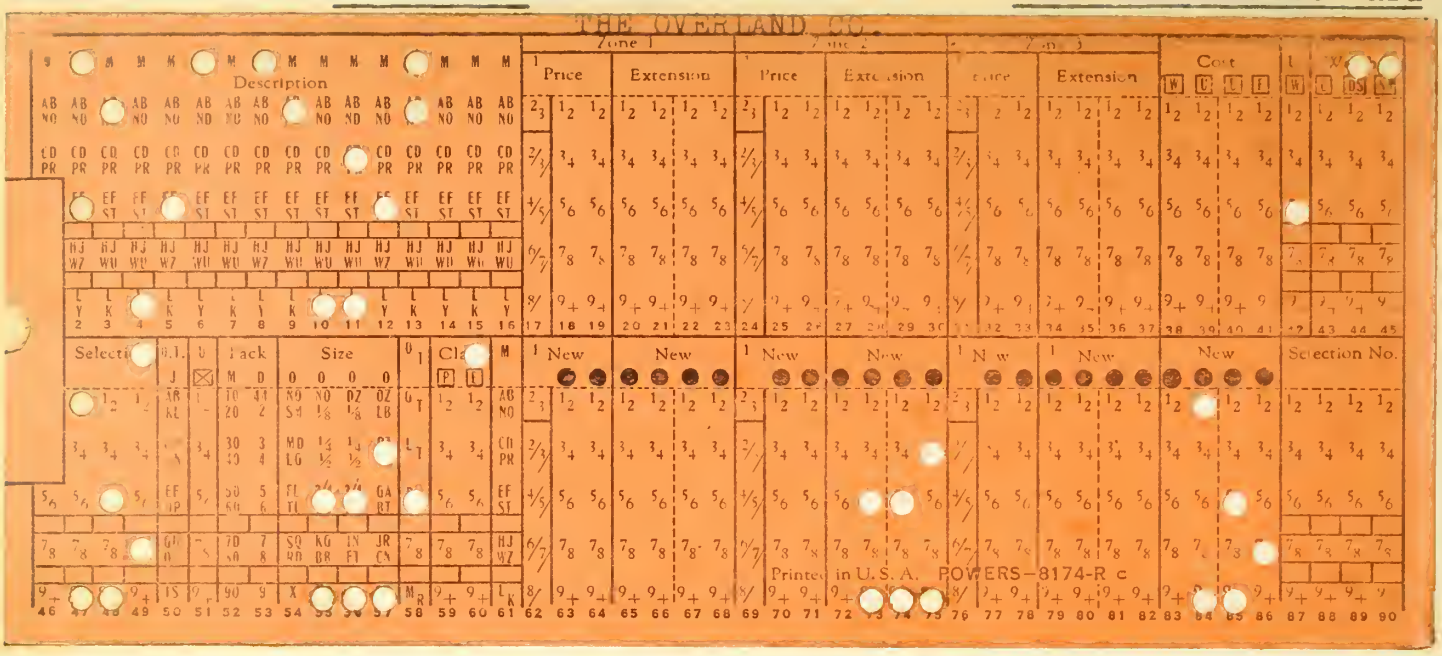

Exhibit 31

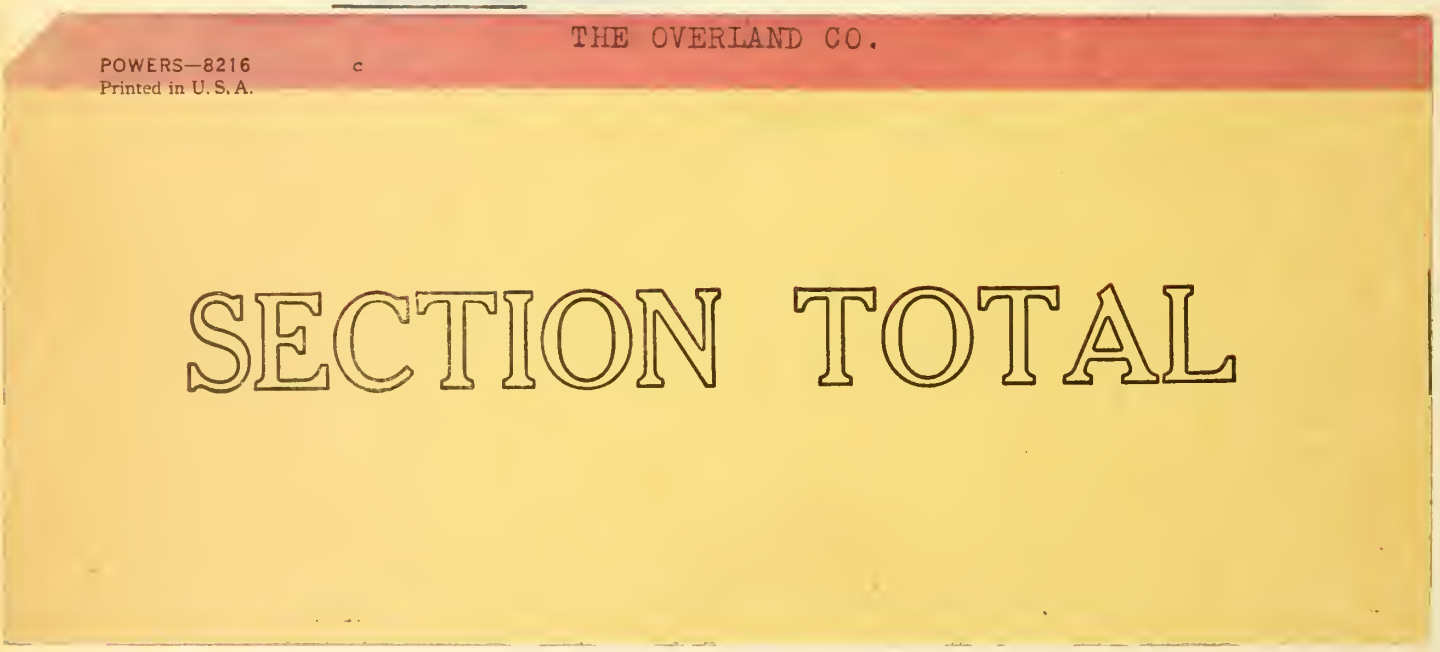

Exhibit 32

last half of the alphabet, and the punching of a sixth position in combination with punching or absence of a third punched position represents those letters coded, respectively, by odd or even digits from 0 to 9 in the card positions. The tabulator automatically selects the right letter to be printed, according as columns are single punched, double punched, or triple punched.

The green striped buff card is prepunched in a control position to cause printing of the units and clearing of the tabulator to show totals by commodity. These cards are manually stacked after each group of inventory cards for like commodity, when cards are pulled from requisitions. In similar fashion, section total cards punched in a different control position from first total cards are stacked at the end of each warehouse section for showing section totals.

The solid orange card is used by the Overland Company as a name and address card for identifying the individual chain store. These name and address cards contain both the store number and the alphabetically punched name and address. A name and address card must be pulled to head all inventory cards for each warehouse section in order that the merchandise applied may be billed and shipped to the correct store.

23.4 Handling of Store Requisitions

The store requisition forms identify all items of stock carried in the central warehouse and indicate the commodity name, the commodity number, the packing unit and the size or contents, All store managers are required to carry

the items printed in capital letters in season. Optional items and those limited for sale in certain groups of stores, are marked accordingly. The store managers are instructed to arrange their stock on shelves in agreement with the order of items listed on requisitions, since this practice standardizes the procedure of taking physical inventory. Stores are also provided with daily requisition forms for fill in and perishable orders, and to simplify the daily routine, stores order only by commodity number and quantity of units wanted. Every store places its stock requisition at least once a week.

When the requisitions are received in the main office they are edited by an order clerk to ascertain whether managers have ordered more merchandise than can be quickly sold. He must add telephone orders and specials to the requisitions. The approved orders are released to the tabulating department for filling. The manner in which prepunched inventory detail cards are pulled from tub files against requisitions has already been discussed. The pulled cards and requisitions are kept separate by individual stores and are released to the tabulating room for preparing invoices as soon as possible.

23.5 Tabulation of Invoices

A battery of alphabetic tabulators is employed for preparation of store invoices. The alphabetical section of a Powers chain store tabulator contains 25 alphabetic sectors with 19 printing positions in each sector. The numeric section has 5 numeric units of 10 sectors each. The last four units also have grand total devices which permit total printing

directly beneath the columns added.

Usually two impressions of the invoice are prepared, of which the original, bearing the stubbed portion used for preparing the order registry and for other control purposes, is sent to the warehouse for filling the order. The copy is sent to the store to check the quantity of merchandise received and to indicate selling prices of individual items. The invoice is headed by store name and address, store number, invoice number, and the date. The store duplicate copy is itemized to indicate the quantity shipped, the packing unit, the size and contents, the name of the commodity, the retail price, and the retail extension. The stubbed original shows additional information for retail price, retail extension, cost, commodity number, and tonnage. The retail price and extension are repeated on the bill because the stubs are detached for punching the order registry.

The physical handling of goods in filling orders is most efficient. In the Overland Company a mono-rail electric truck assembly system is used. Most of the heavy bulk items are located on the lower floor in order to make full use of gravity by eliminating elevator traffic for bulky products. The assembly of the order begins on the top floor. The trucks run on a rail in a straight line past individual bins and clerks assemble those articles needed. The truck proceeds up one row and down another until the floor has been completely covered. Other floors are similarly covered. Breakable or easily damaged goods are carefully handled. Refrigerators are

placed on the two lower floors so that perishables may be the last items selected. By the time the mono-rail truck has reached the last station on the main floor, the complete order will have been assembled. The load is immediately transferred to the dummy truck chassis which will be used in delivery. An empty truck returns to the warehouse after completing a route, its empty chassis is detached, and a fully loaded chassis for another route is fastened to the frame, all in the short space of a few moments required for the driver to secure store invoices and delivery instructions. There is no handling time lost at any point in the distribution service, since full loads are packed in advance and since the Overland Company has sufficient trucks to even the flow of work.

Meanwhile cards have been punched from the detached stubs to record store number, commodity number, retail price, retail extension, cost extension and tonnage. The completed and shipped warehouse invoice is checked against the order register, so that a control may be exercised over all invoices forwarded for shipment.

23-6 Factory Warehouse and Store Inventory Control

At periodical intervals a physical count is made of all merchandise in the warehouse for comparison with the perpetual inventory punched cards in the tub files. Differences are adjusted by adding to or deducting from the punched cards to bring them into agreement with the physical inventory. The physical count and check of different sections is made at different regular periods in order not to create a severe peak of

stock taking.

Unannounced and frequent checks are made to verify the stocks of individual stores. The daily cash receipts of stores are either collected daily by armored car messengers or deposited daily to the company's account in local banks. The value of the opening inventory, plus the value of shipments into store stock, less the combined values for cash receipts, returns, shrinkage, and spoilage should equal the value of the inventory on hand. Store managers are allowed a small tolerance for shrinkage, but whenever the inventory of a particular manager regularly reveals short stocks generally the store manager is dismissed because of the implication of dishonesty.

23.7 Shipment and Sales Analysis

After the invoices have been prepared, the inventory cards are sorted by department and a tabulation is run showing retail value, cost, and tonnage, and summary cards are punched for each department.

The daily summary cards prepared above are accumulated until the end of the week, when a report is tabulated for the week's shipping activity, indicating, by departments, the retail value, cost, and tonnage of merchandise shipped.

23.8 Advantages of the Punched Card System

The Overland Company derives the following advantages from the use of tabulating machines for inventory control:[91]

(a) Positive and accurate perpetual inventory control.
(b) Automatic, rapid, and accurate billing.

91 Grocery Chains, Powers Bulletin Page 66.

(c) Concentration of sales effort on profitable items.
(d) Reduction of capital investment in inventories.
(e) Correct and flexible repricing merchanism.
(f) Increased efficiency of purchasing.
(g) Reduction in warehouse, office, and trucking expenses.
(h) Control of retail outlets.
(i) Improvement in managerial direction.

24.0 Accounts Payable Control in a Public Utility

24.1 Character of the Accounts Payable Problem

The Eastern Gas and Fuel Associates Company, of Boston, Massachusetts is the operating company of a system of fourteen affiliated companies engaged in the importation of coal and coke, the manufacture of gas, and the distribution of gas, coal, and coke. It operates a fleet of eighteen vessels which convey coal directly from the mines to the manufacturing plant at Everett, Massachusetts. The Eastern Gas and Fuel Company exercises operating control over the thirteen subsidiaries. Creditors' invoices for purchases from all vendors who sell to any companies of the entire system are paid centrally by the Eastern Gas and Fuel Company. New England Coal and Coke Company, and the Mystic Steamship Company. 4000 drafts a month are issued in payment of bills, and control is exercised over the expenditure of funds for each of the fourteen companies. The number of expense distributions averages three accounts per invoice, or 12,000 accounts charges per month. Up to Jan. 1, 1935 a manual bookkeeping procedure was employed to control accounts payable. Because of the maintenance of a separate Voucher Register and Check Register for each Company, the decentralization of approval of invoices by individual companies

in some cases, the voluminous columnar working sheets necessary for expense analysis, and the extensive peak overtime work caused by closing the books, the results accomplished by the accounts payable routine were unsatisfactory. The cost of the accounts payable system was high, long periods of overtime each month undermined the health and efficiency of employees, dates of closing were always late, and the bookkeeping was both involved and inflexible. On January 1, 1935, a punched card system was adopted which was at once successful in eliminating the disadvantages of the former manual methods at a tangible annual saving of about $8,000 a year, apart from equally as important intangible benefits.[92]

24.2 Accounts Payable Routine under the Tabulating Method

Each of the fourteen companies acts as a separate unit to number invoices received each month, consecutively beginning with #1. The Eastern Gas and Fuel Company, Mystic Steamship Company, and New England Coal and Coke Company establish two files, one for bills payable awaiting material received manifests and the other for manifests awaiting bills. A sticker is attached to each invoice upon receipt which provides spaces for entering all information in connection with the vouchering, distribution, and payment of the invoice. This sticker will later be shown with the tabulating cards used. With respect to vouchering, the bill sticker indicates the date invoice was received, the company number, draft number, date of invoice, due date, vendor number, accounts payable account, transaction number, order number, and the invoice amount.

92 Statement of Auditor - Eastern Gas and Fuel Co.

Spaces are provided for intialing the checking of the prices, extensions, and terms of the invoice against the purchase order. From the materials received manifest, a clerk marks on the bill sticker the date of receipt of material or rendering of service, who received the material, and who examined and approved the material. A credit manifest is issued when goods are returned to vendor; the amount of any credit manifest is a deduction from the gross amount of the proper invoice to which it is applied, and the bill sticker is netted in amount for the subtraction.

When invoices are received from subsidiaries, the charge and credit manifests are pulled and stapled to the corresponding bills. Either a bill sticker is affixed to each bill or a sticker impression is stamped. Coding clerks insert the vendor number from a visible index spindle file. The bills are coded by company number. Since no credit stickers are issued, credits are netted on charge stickers as deductions. Following the coding and proving of the invoice, the account distribution is classified on the bill sticker. The distribution is classified by plant or vessel, by account number (which consists of codes for division, group, job, and class), and by amount charged. The cash discount and other deductions are applied to the gross invoice amount to determine the net amount payable to each bill.

The bills are forwarded to Boston Office departments for necessary approvals, and final approvals are made by the accounting department. The fully approved invoice is stamped

with draft (and/or bill) number. The draft numbers run serially for each month, regardless of company identity. Missing or duplicated draft numbers will not be tolerated. The approved bill is forwarded to the tabulating department. The tabulating department issues draft and distribution cards, stamping the bill with tabulating department stamp to signify that the draft was issued. Different draft card forms are used in accordance with the clearing of the drafts through different banks. The draft and bill are presented to the treasurer for signature. The signed draft with bill is returned to the tabulating department. The signed draft is filed by due date; the bill is returned to the accounting department and filed in a vendor folder. The signed draft is presented to the treasurer for mailing on the due date.

At closing time, it is necessary to send unapproved bills to the tabulating department. These bills are kept separate from approved invoices so that the tabulating department, after originating the draft, can stamp "Unapproved - return to tabulating department." When complete approvals have been obtained, the draft is presented for signature and the "Unapproved" stamp is deleted.

24.3 Bill Sticker and Tabulating Card Forms

This efficient accounts payable routine evolves by adaptation of a few carefully designed forms as follows:

Exhibit 33 - Bill sticker
Exhibit 34 - New England Coke Company card draft
Exhibit 35 - Accounts Payable distribution card
Exhibit 36 - Accounts Payable draft duplicate

G-6 Exhibit 33 DATE INVOICE RECEIVED Bill Sticker

COMPANY NO.	DATE MATERIAL REC'D. OR SERVICE RENDERED	PLANT OR VESSEL TYPE	DISTRIBUTION DIVISION	GROUP	JOB	SUB	AMOUNT DISTRIBUTED
DRAFT NO.	MATERIAL RECEIVED BY						
INVOICE DATE	MAT'L. EXAMINED AND O.K'D. BY						
VENDOR NO.	CREDIT MFS'T. NO.						
DUE DATE	APPROVALS PLANT OFFICE						
A/P ACCOUNT	PLANT SUP'T.						
TRANSACTION NO.	PUR. DEPT.						
ORDER NO.	ADM. DEPT'S.						
ORDER AND PRICE CHECKED BY	AUDITOR	INVOICE AMOUNT					
		OTHER DEDUCTIONS					
EXTENSIONS CHECKED BY		CASH DISCOUNT					
	TERMS	NET AMOUNT PAYABLE					

Eastern Gas & Fuel

IF THIS INVOICE IS VOIDED RETURN WITH STICKER TO ACCOUNTING DEP'T.
DO NOT DETACH STICKER FROM INVOICE

Exhibit 34

TO ADDRESSEE THIS DRAFT IS ISSUED IN FULL SETTLEMENT OF THE FOLLOWING INVOICE. KINDLY ENDORSE ON REVERSE SIDE AND DEPOSIT AT ONCE
TO THE TREASURER OF

NEW ENGLAND COKE COMPANY

1938 BOSTON, MASS. AT SIGHT PAY

DRAFT MO	DRAFT DAY	DRAFT NO.	YOUR INVOICE OF MO	YOUR INVOICE OF DAY	GROSS AMOUNT	CASH DISCOUNT	OTHER DEDUCTIONS	DOLLARS	CENTS

TO THE ORDER OF

NEW ENGLAND COKE COMPANY

By
COUNTERSIGNED ASST. TREASURER

THRU: THE FIRST NATIONAL BANK 5-39
OF BOSTON
BOSTON, MASS.

SECRETARY-TREASURER

I.B.M. 132937

LICENSED FOR USE UNDER PATENT 1,772,492

Exhibit 35 ACCOUNTS PAYABLE DISTRIBUTION

JOURNAL ENTRIES — ROSE STRIPE
ACCOUNTS PAYABLE DISTRIBUTION — MANILA

SUM. PUN.	TRANS	COMPANY	JOURNAL OR DRAFT NO. MO.	JOURNAL OR DRAFT NO. NO	DATE MO.	DATE DAY	VENDOR NO.	PLANT VESSEL TYPE	ACCOUNT DIV.	ACCOUNT GR'P	ACCOUNT JOB	ACCOUNT SUB	APPROP. OR REPAIR JOB NO.	AMOUNT	X	CR.
0	0	0	0 0	0 0 0	0 0	0 0	0 0 0 0	0 0	0 0 0	0 0	0 0	0	0 0 0 0	0 0 0 0 0 0 0 0	0	0
1	1	1	1 1	1 1 1	1 1	1 1	1 1 1 1	1 1	1 1 1	1 1	1 1	1	1 1 1 1	1 1 1 1 1 1 1 1	1	1
2	2	2	2 2	2 2 2	2 2	2 2	2 2 2 2	2 2	2 2 2	2 2	2 2	2	2 2 2 2	2 2 2 2 2 2 2 2	2	2
3	3	3	3 3	3 3 3	3 3	3 3	3 3 3 3	3 3	3 3 3	3 3	3 3	3	3 3 3 3	3 3 3 3 3 3 3 3	3	3
4	4	4	4 4	4 4 4	4 4	4 4	4 4 4 4	4 4	4 4 4	4 4	4 4	4	4 4 4 4	4 4 4 4 4 4 4 4	4	4
5	5	5	5 5	5 5 5	5 5	5 5	5 5 5 5	5 5	5 5 5	5 5	5 5	5	5 5 5 5	5 5 5 5 5 5 5 5	5	5
6	6	6	6 6	6 6 6	6 6	6 6	6 6 6 6	6 6	6 6 6	6 6	6 6	6	6 6 6 6	6 6 6 6 6 6 6 6	6	6
7	7	7	7 7	7 7 7	7 7	7 7	7 7 7 7	7 7	7 7 7	7 7	7 7	7	7 7 7 7	7 7 7 7 7 7 7 7	7	7
8	8	8	8 8	8 8 8	8 8	8 8	8 8 8 8	8 8	8 8 8	8 8	8 8	8	8 8 8 8	8 8 8 8 8 8 8 8	8	8
B.F. 9	9	9	9 9	9 9 9	9 9	9 9	9 9 9 9	9 9	9 9 9	9 9	9 9	9	9 9 9 9	9 9 9 9 9 9 9 9	9	9
1 2 3 4 5 6 7 8 9	10 11 12 13 14 15 16 17 18	19 20 21 22 23 24 25 26 27	28 29 30 31 32 33 34 35 36	37 38 39 40 41 42 43 44 45	46 47 48 49 50 51 52 53 54	55 56 57 58 59 60 61 62 63	64 65 66 67 68 69 70 71 72	73 74 75 76 77 78 79 80								

EASTERN GAS & FUEL ASSOCIATES

I.B.M 532015 LICENSED FOR USE UNDER PATENT 1 772 492

Exhibit 36

COMPANY	DRAFT MO.	DRAFT NO	INVOICE DATE MO	INVOICE DATE DAY	VENDOR NO	DUE DATE MO.	DUE DATE DAY	PA A/C	TRANS	INVOICE AMOUNT	CASH DISCOUNT	OTHER DEDUCTIONS	NET AMOUNT	CHECK NO. MO.	CHECK NO. NO	BANK NO.	DATE PAID MO	DATE PAID DAY	DATE PAID Y.
0	0 0	0 0 0	0 0	0 0	0 0 0 0	0 0	0 0	0 0 0	0	0 0 0 0 0 0 0 0	0 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0	0 0 0 0	0 0 0	0 0	0 0	0
1	1 1	1 1 1	1 1	1 1	1 1 1 1	1 1	1 1	1 1 1	1	1 1 1 1 1 1 1 1	1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1	1 1 1 1	1 1 1	1 1	1 1	1
2	2 2	2 2 2	2 2	2 2	2 2 2 2	2 2	2 2	2 2 2	2	2 2 2 2 2 2 2 2	2 2 2 2	2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2	2 2	2 2 2 2	2 2 2	2 2	2 2	2
3	3 3	3 3 3	3 3	3 3	3 3 3 3	3 3	3 3	3 3 3	3	3 3 3 3 3 3 3 3	3 3 3 3	3 3 3 3 3 3 3 3	3 3 3 3 3 3 3 3	3 3	3 3 3 3	3 3 3	3 3	3 3	3
4	4 4	4 4 4	4 4	4 4	4 4 4 4	4 4	4 4	4 4 4	4	4 4 4 4 4 4 4 4	4 4 4 4	4 4 4 4 4 4 4 4	4 4 4 4 4 4 4 4	4 4	4 4 4 4	4 4 4	4 4	4 4	4
5	5 5	5 5 5	5 5	5 5	5 5 5 5	5 5	5 5	5 5 5	5	5 5 5 5 5 5 5 5	5 5 5 5	5 5 5 5 5 5 5 5	5 5 5 5 5 5 5 5	5 5	5 5 5 5	5 5 5	5 5	5 5	5
6	6 6	6 6 6	6 6	6 6	6 6 6 6	6 6	6 6	6 6 6	6	6 6 6 6 6 6 6 6	6 6 6 6	6 6 6 6 6 6 6 6	6 6 6 6 6 6 6 6	6 6	6 6 6 6	6 6 6	6 6	6 6	6
7	7 7	7 7 7	7 7	7 7	7 7 7 7	7 7	7 7	7 7 7	7	7 7 7 7 7 7 7 7	7 7 7 7	7 7 7 7 7 7 7 7	7 7 7 7 7 7 7 7	7 7	7 7 7 7	7 7 7	7 7	7 7	7
8	8 8	8 8 8	8 8	8 8	8 8 8 8	8 8	8 8	8 8 8	8	8 8 8 8 8 8 8 8	8 8 8 8	8 8 8 8 8 8 8 8	8 8 8 8 8 8 8 8	8 8	8 8 8 8	8 8 8	8 8	8 8	8
9	9 9	9 9 9	9 9	9 9	9 9 9 9	9 9	9 9	9 9 9	9	9 9 9 9 9 9 9 9	9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9	9 9 9 9	9 9 9	9 9	9 9	9
1 2 3 4 5 6 7 8 9	10 11 12 13 14 15 16 17 18	19 20 21 22 23 24 25 26 27	28 29 30 31 32 33 34 35 36	37 38 39 40 41 42 43 44 45	46 47 48 49 50 51 52 53 54	55 56 57 58 59 60 61 62 63	64 65 66 67 68 69 70 71 72	73 74 75 76 77 78 79 80								

EASTERN GAS & FUEL ASSOCIATES

DUPLICATE DRAFT LICENSED FOR USE UNDER PATENT 1 772,492 I.B.M 532014

It may be at once noticed that all the vital information appearing on the bill sticker is punched into the draft, the distribution, and the draft duplicate tabulating cards, respectively. The card draft is prepared and punched by the International interpreting check writing machine. The punched holes in the tabulating card draft, which are obtained by manual punching in the duplicator, are run through the interpreter to record printed figures in the blocked fields at the top of the card, entirely decoding the punched fields and by simultaneous cutting of the net amount, doing away with the protectograph check writer.

No accounts payable card is used to record any bill. When the system was first begun an unapproved Invoice Register was prepared from punched and key verified tabulating cards. Distribution cards were punched and verified from the approved distribution, and a Distribution Register was prepared which was balanced in gross amount with the total amount of the audited Invoice Register. This system was later abandoned, as it was found possible to eliminate the Invoice Register by adopting the daily punched card control of a Drafts Payable Register to prove with the gross amount tabulated for the distribution. The daily checking of the Drafts Payable Register against the Distribution Register is now possible because both the draft card and the distribution card are prepared on the same day from the bill sticker. The signed draft cards are sorted by due date and the distribution cards are filed by control account. Since the name and address of the vendor was

typed on the face of the draft when it was originated, the draft is ready for release by the treasurer when it is pulled on the due date.

The drafts received by the addressees are collected and cleared through the depository banks of the drawing companies. Each day the bank notifies the drawer of the drafts of the total value of the drafts cleared, by individual companies. Separate checks are issued by the drawing company to purchase the sight drafts of the individual companies which have been cleared.

The redeemed drafts constitute the basis for tabulating the Register of Drafts Paid, of which more will be mentioned later. The payment procedure is injected here to emphasise that a draft duplicate card is prepared by summary punch when the Register of Drafts Paid is tabulated. The draft duplicate not only is a reproduction of all the information in the original draft but also is punched with the check number, the bank number, and the payment date. The draft duplicate cards are filed by company and vendor number and contain the complete record of the invoice date, vendor number, due date, transaction, invoice amount, deductions, net amount, bank number, check number, and date paid. Thus one draft duplicate card, containing a punched registration of all significant fields, is obtained as the final record, summarizing the activity in paying one invoice.

24.4 Daily Tabulations

The Register of Drafts Payable is tabulated daily

for check in gross amount with the total obtained by proof with the distribution cards. The draft cards and distribution cards must agree in total by companies for they were both punched and verified from information appearing on the bill sticker. A separate Register of Drafts Payable is tabulated for each company. One invoice is always represented by one draft card and, on the average three distribution cards.

The Register of Drafts Payable is tabulated by company, by due date and projects cash requirements. This report itemizes for each draft the due date, other deductions, draft number, vendor number, gross invoice amount, cash discount, and draft net amount.

The distribution cards are tabulated daily for preparation of the Distribution Register, which is used, in total amount, to check the Drafts Payable Register. Following the proof the distribution cards are sorted by account number and are filed behind control cards, each company separately. The Distribution Register shows company number, plant or vessel type, reference number, vendor number, appropriation or repair job number, account number, and the debit and credit amounts of journal entries.

Drafts are both added and pulled from the open draft file daily. The drafts added represent signed drafts for bills payable which have been returned from the office of the treasurer; these drafts are filed by due date. All drafts due are pulled from the open file daily and tabulated by company to

produce a Register of Drafts Released. A summary card is punched daily to balance forward the total value of drafts released for each company. The released drafts are sent to the treasurer's office for mailing.

Each day the drawing companies of the system are notified by the banks as to the value of collected drafts which have been cleared. The drawing companies issue daily checks to purchase the cleared drafts, one separate check to cover the drafts of each drawing company. The purchased drafts are sent to the tabulating department for preparation of the Register of Drafts Paid. A summary card duplicate draft is prepared from this tabulation, which is both reproduced for fields in the original draft and is punched with check number, bank number, and date of payment. The Register of Drafts Paid is run by individual companies and provides the basis for the journal entry,

Dr.	Accounts Payable	- for gross amount paid
Cr.	Cash	- for value of checks
Cr.	Cash Discount	- for purchase discount taken
Cr.	Other Deductions	- for other deductions taken

The Register of Drafts Paid is prepared by individual company and provides the basis for transfers of bank balances between members of the system in settlement of the payment service rendered.

The duplicate draft cards are sorted and tabulated daily with the summary cards obtained from preparing the Register of Drafts Released in order to provide the Register of Drafts Outstanding. This tabulation is an application of class selection, for the duplicate drafts are punched X-80,

causing a deduction from the released draft cards which are punched No-X 80 to produce either a zero balance if the draft has been paid or an outstanding balance if the draft has not been paid. The two sets of cards are sorted together by company number by draft number and are tabulated in the Register of Drafts Outstanding according to the following arrangement of machine counters:

Counter #1	Counter #2	Counter #3	Counter #4	Counter #5
Draft No.	Date	Net Amount	Net Amount	Net Amount
Vendor No.	Check No.	Released	Paid	Outstanding
4-7x12-16	61-64x54-57	44-51	44-51	44-51
		(No-X 80)	(X-80)	Difference

24.5 Monthly Work

A monthly trial balance is run from the distribution file by company and account number, classifying the expense distribution by debit amount, credit amount, and net amount. The distribution summary cards which are punched when preparing the trial balance are used to post the controlling accounts in the general ledger.

The Eastern Gas and Fuel Company has found punched cards so well adapted to its requirements that the tabulating method has been extended from control of accounts payable to the monthly tabulation of the entire general ledger from use of punched cards. Many of the exact account classifications necessary for the general books are directly obtained as by-products of the tabulating machine method. Other entries are summarized and journalized by hand. Once the transaction cards for the current month are completely punched and verified a monthly trial balance is prepared of the general ledger of each of the fourteen companies, and the books are closed.

The Eastern Gas and Fuel Company is greatly pleased with the results accomplished by use of tabulating machines for general ledger accounting. The work is much speedier than the former manually posted bookkeeping routine. Summary entries are quickly prepared for posting controlling accounts. By means of balance forward summary cards and use of the principles of class selection and direct subtraction, cumulative figures are simply prepared. All of the tabulated accounts in the general ledger are neatly printed, compactly arranged and uniform. The reaction of the public auditors to the entire system is interesting.[93] They were at sea when making the first annual audit of the tabulated general ledger because they did not know the principles of tabulating and employed minute verifications from source data in an especially rigid search for errors. The auditors reported that the accounts were especially correct. When making the audit of July 1937, the auditors were well impressed because they knew more about the exacting controls which supported the accounts. Following the annual audit for 1937, the auditing firm was most enthusiastic about the punched card system, after their investigation into the tabulating routine, and directly as a result of their observing the ease, dispatch, flexibility, and accuracy with which reports are prepared.

24.6 Advantages of Punched Cards to the Eastern Gas and Fuel Company[94]

One of the prime measures of the pleasing results obtained by use of punched cards in the annual saving in direct cost of about $8,000 a year, composed as follows:

93 Statement of Auditor: Eastern Gas & Fuel Co.
94 Comments of Auditor: Eastern Gas & Fuel Co.

Nature of Item	Monthly Saving
Transfer of 4 clerks to other work	$450.00
Reduction in monthly overtime	250.00
Depreciation	400.00
Gross Monthly Saving	$1100.00
Less: Monthly machine rental	435.00
Net Monthly Saving	$ 665.00

More important than the cost reduction is the improved efficiency of the entire accounting office. With overtime work reduced to a minimum, the health of employees and the quality of their work is much improved. The success already achieved is but a forerunner of more substantial economies which will result as punched cards are applied to other accounting work of the association.

25.0 Railroad Car Accounting and the Preparation of Operating Statistics.[95]

25.1 Presentation of the Problem

In 1925 an extensive study toward improved facilities was made by the Boston and Maine Railroad, and much time was applied to develop more effective supervision and better train operation. The accounting department in its work in the study discovered a lack of knowledge on the part of operating officers regarding 90 per cent of the direct expenses that vary with volume of traffic. The lack of information embodied cost of passenger and freight operations, gross ton-miles, gross tons per train-hour, train-miles per train-hour, pounds of coal per thousand train-miles, wage costs, fuel costs, and locomotive repair cost. This unfortunate condition was due to the fact that although the information was readily available, proper statistics had never been provided in such form and at such time to be of any value.

The accounting department was assigned the task of assembling the information received daily in the office of the car accountant and from other accounting records available so that statistics of a daily or weekly nature could be provided for operating officials with the purpose of eliminating bad practices or costly operations as soon as they developed. A bureau of statistics was established as a subsidiary division of the accounting department. The Boston and Maine, in common with other railroads, was using a wheel report with a half sheet flap, the flap being used in the car accountant's office for recording car movements and preparing per diem reports, and the full sized wheel reports

95 Based on excerpts from "Railway Age", April, 1933 from article by G. F. Glacy, Comptroller, Boston & Maine

being handled by the bureau of statistics for use in preparation of daily and weekly operating statistics.

It was recognized that the clerical and calculating machine effort in compiling car records, per diem reports and statistics was a more costly operation than was warranted. Furthermore, the wheel report was being used for two different purposes, entailing clerical work which was in some sense a duplication of work.

25.2 Adoption of Powers Tabulating Machines

After fifteen months' study of the problem, Powers tabulating machines were installed in the office of the car accountant in October, 1932, for use in compiling operating statistics and performing the work of the car accountant. The following tabulating equipment was installed:

2 Automatic key punches, dual
6 Automatic key punches
1 Summary card punch
1 Interpreter
2 Non-counting sorters
1 Counting sorter
2 7 unit printing tabulators, 10 sector
1 5 unit printing tabulator

The installation has accomplished a net saving in payroll of $10,000 a year, while providing a system of accounting embodying many improvements and making available statistical information of indeterminate value.

25.3 Advantages of the New Method

1. Conductors and interchange clerks are allowed to use ditto marks when preparing wheel and interchange reports, reducing their clerical work 40 per cent.

2. The elimination of the half sheet flap for cut up

slips materially speeds up the work. There are no slips to become mutilated or lost.

3. A more accurate car record is produced. Punch clerks who transcribe from the original data are always correct in classification because the data is key punched and verified at the source. Under the manual basis, clerks had to find the proper page in the card record book, hunt for the previous records of car movement, find the proper date for making the entry, and post the entry. It was easy to enter records opposite the wrong car because the slip was passed, or lost, or mutilated in cutting. The tabulated record reduced the number of car record books by 65%, saving paper, cost of printing, binders and filing space. The printed reports are more compact and more easily read.

4. The necessity for manual car count, which is expensive, limited, and inaccurate is eliminated. Punched interchange cards which record receipts are sorted in machines at a rate of 400 cards per minute and are counted automatically. The count is divided by system and foreign cars, by ownership and classes of equipment.

5. Each day a tabulation of foreign cars received is sent to the disposition clerk. By providing an independent disposition report for home routing it is not necessary to consult the car record books as before.

6. Under the tabulating method, records are compiled daily and work does not accumulate. Under the punched card method it is necessary to pull cards for foreign cars received to match entries on interchange reports for foreign cars delivered. In the daily routine, if a clerk fails to find a

receipt record of the car in the foreign interchange file, it immediately indicates short receipt or clerical error. The card file of car records provides the answer, and is easily referred to for adjusting differences such as reporting the car under the wrong owners mark, since cards are filed in strict numerical order.

7. The need for transferring records from one month's books to the next was a slow and expensive operation, and full of inaccuracies under the manual plan. These disadvantages are avoided under the punched card plan by reproducing into new cards all foreign cards on hand with positive accuracy, which assures correct records for determining the current month's per diem.

8. The time required for producing per diem reports is reduced from fourteen days to twenty hours each month.

9. The figuring of private line car mileage under the manual plan required that mileage be computed and entered in private line car record books for each car. This permitted errors in figuring, noting, and transcribing the mileage statements. Under the punched card method, the mileage is punched from conductors' wheel reports, which permits tabulated statements of mileage, showing the cars by classes in numerical order.

10. Under the manual plan, the compilation of car, train and locomotive statistics is performed as a separate and costly calculating machine operation. The number of empty and loaded cars must be counted and recorded. The loaded and empty car miles, net and gross ton-miles must be accumulated by multiplying and accumulating the number

of cars, net and gross tons for each distance, and recording the results.

Under the punched card, statistics are provided as a by-product of car records and are available for distribution the day following the arrival of basic data in the car accountant's office. The current statistical data made available is of more value than the $10,000 payroll saving permitted under the plan. The basic details for car accounting and operating statistics are obtained from three daily reports: first, conductors' wheel reports; second, interchange reports issued at junction points; third, passenger conductors' wheel reports. These reports make available daily statements by trains of the number of loaded and empty cars hauled, loaded and empty car-miles, net and gross ton-miles, and train-hours. This information may be secured by individual trains, by direction, by operating divisions, by main lines, and by branch lines. Data is also available for studies of traffic density.

25.4 Specimen Tabulating Card Forms Under the Plan

The basic information is transferred from basic source data by punching into the following tabulating cards:

Exhibit 37 -- Freight Car Card
Exhibit 38 -- Locomotive Card
Exhibit 39 -- Statistical Card
Exhibit 40 -- Interchange and Per Diem Card
Exhibit 41 -- Wheel Report Card

Freight car and locomotive cards are punched from edited wheel reports and locomotive slips daily. Freight car cards are punched for car initial and number, kind, loaded or empty, train symbol number, date time and station taken,

Exhibit 37

FREIGHT CAR CARD

Car Initials	Car Number	Kind	Load	Net Tons	Gross Tons	Train Symbol	Mo	Day	Time Hr.	Time Min.	Station Taken	Station Left	Day	Time Hr.	Time Min.	Car Miles
56 56 56	56 56 56 56 56 56	56 56	56 56	56 56 56	56 56 56	56 56 56 56	56 56	56 56	56 56	56 56	56 56 56 56	56 56 56 56	56 56	56 56	56 56	56 56 56
78 78 78	78 78 78 78 78 78	78 78	78 78	78 78 78	78 78 78	78 78 78 78	78 78	78 78	78 78	78 78	78 78 78 78	78 78 78 78	78 78	78 78	78 78	78 78 78
9 9 9	9 9 9 9 9 9	9 9	9 9	9 9 9	9 9 9	9 9 9 9	9 9	9 9	9 9	9 9	9 9 9 9	9 9 9 9	9 9	9 9	9 9	9 9 9
1 2 3	4 5 6 7 8 9	10 11	12 13	14 15 16 17	18 19 20 21	22 23 24 25	26 27	28 29	30 31	32 33	34 35 36	37 38	39	40	41 42	43 44 45
9 9 9	9 9 9 9 9 9	9 9	9 9	9 9 9	9 9 9	9 9 9 9	9 9	9 9	9 9	9 9	9 9 9 9	9 9 9 9	9 9	9 9	9 9	9 9 9
8 8 8	8 8 8 8 8 8	8 8	8 8	8 8 8	8 8 8	8 8 8 8	8 8	8 8	8 8	8 8	8 8 8 8	8 8 8 8	8 8	8 8	8 8	8 8 8
5 5 5	5 5 5 5 5 5	5 5	5 5	5 5 5	5 5 5	5 5 5 5	5 5	5 5	5 5	5 5	5 5 5 5	5 5 5 5	5 5	5 5	5 5	5 5 5
Car Miles	Time Min.	Time Hr.	Day	Station Left	Station Taken	Train Symbol	Mo	Day	Train Symbol	Gross Tons	Net Tons	Load	Kind	Car Number	Car Initials
12 12 12	12 12 12 12 12 12	12 12	12 12	12 12 12	12 12 12	12 12 12 12	12 12	12 12	12 12	12 12	12 12	12 12	12 12	12 12 12	12 12 12

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BOSTON AND MAINE RAILROAD

Exhibit 38

LOCOMOTIVE CARD

Loco. Initial and Number	Mo.	Day	Train Symbol	Class Service	Principal Miles	Helper Miles	Swt'g Miles	Term.	Light Miles	Station From	Station To	Train Hrs. and Tenths	Weight	Mo.	Day	Train Symbol	Class Service	Principal Miles	Helper Miles	Swt'g Miles	Term.	Light Miles	Station From	Station To	Train Hrs. and Tenths	Weight
34 34 34 34	34 34	34 34	34 34 34 34	34 34	34 34 34	34 34 34	34 34	34	34 34 34	34 34 34 34	34 34 34 34	34 34	34	34	34 34	34 34 34 34	34 34	34 34 34	34 34 34	34 34	34	34 34 34	34 34 34 34	34 34 34 34	34 34	34
56 56 56 56	56 56	56 56	56 56 56 56	56 56	56 56 56	56 56 56	56 56	56	56 56 56	56 56 56 56	56 56 56 56	56 56	56	56	56 56	56 56 56 56	56 56	56 56 56	56 56 56	56 56	56	56 56 56	56 56 56 56	56 56 56 56	56 56	56
78 78 78 78	78 78	78 78	78 78 78 78	78 78	78 78 78	78 78 78	78 78	78	78 78 78	78 78 78 78	78 78 78 78	78 78	78	78	78 78	78 78 78 78	78 78	78 78 78	78 78 78	78 78	78	78 78 78	78 78 78 78	78 78 78 78	78 78	78
9 9 9 9	9 9	9 9	9 9 9 9	9 9	9 9 9	9 9 9	9 9	9	9 9 9	9 9 9 9	9 9 9 9	9 9	9	9	9 9	9 9 9 9	9 9	9 9 9	9 9 9	9 9	9	9 9 9	9 9 9 9	9 9 9 9	9 9	9
1 2 3 4	5 6	7 8	9 10 11 12	13 14	15 16 17	18 19 20 21	22 23	24	25 26 27	28 29 30 31	32 33 34 35	36 37	38	39	40 41	42 43 44 45	1 2 3 4	5 6 7 8	9 10 11 12	13 14	15	16 17 18	19 20 21 22	23 24 25 26	27 28	29
9 9 9 9	9 9	9 9	9 9 9 9	9 9	9 9 9	9 9 9	9 9	9	9 9 9	9 9 9 9	9 9 9 9	9 9	9	9	9 9	9 9 9 9	9 9	9 9 9	9 9 9	9 9	9	9 9 9	9 9 9 9	9 9 9 9	9 9	9
8 8 8 8	8 8	8 8	8 8 8 8	8 8	8 8 8	8 8 8	8 8	8	8 8 8	8 8 8 8	8 8 8 8	8 8	8	8	8 8	8 8 8 8	8 8	8 8 8	8 8 8	8 8	8	8 8 8	8 8 8 8	8 8 8 8	8 8	8
5 5 5 5	5 5	5 5	5 5 5 5	5 5	5 5 5	5 5 5	5 5	5	5 5 5	5 5 5 5	5 5 5 5	5 5	5	5	5 5	5 5 5 5	5 5	5 5 5	5 5 5	5 5	5	5 5 5	5 5 5 5	5 5 5 5	5 5	5
12 12 12 12	12 12	12 12	12 12 12 12	12 12	12 12 12	12 12 12	12 12	12	12 12 12	12 12 12 12	12 12 12 12	12 12	12	12	12 12	12 12 12 12	12 12	12 12 12	12 12 12	12 12	12	12 12 12	12 12 12 12	12 12 12 12	12 12	12

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BOSTON AND MAINE RAILROAD

Exhibit 39

FREIGHT STATISTICS

Mo.	Day	Train Symbol	Station Taken	Station Left	No. Cars Loaded	No. Cars Empty	Car Miles Loaded	Car Miles Empty	Net Tons (Ton Miles)	Gross Tons (Ton Miles)	Net Tons (Ton Miles)	Gross Tons (Ton Miles)	Train Symbol	Station Taken	Station Left	No. Cars Loaded	No. Cars Empty	Car Miles Loaded	Car Miles Empty	Day	Mo.
34 34	34 34	34 34 34 34	34 34 34 34	34 34 34 34	34 34 34	34 34 34	34 34 34	34 34	34 34 34	34 34 34	34 34 34	34 34 34	34 34 34	34 34 34	34 34 34	34 34 34	34 34 34	34 34 34	34 34	34 34	34
56 56	56 56	56 56 56 56	56 56 56 56	56 56 56 56	56 56 56	56 56 56	56 56 56	56 56	56 56 56	56 56 56	56 56 56	56 56 56	56 56 56	56 56 56	56 56 56	56 56 56	56 56 56	56 56 56	56 56	56 56	56
78 78	78 78	78 78 78 78	78 78 78 78	78 78 78 78	78 78 78	78 78 78	78 78 78	78 78	78 78 78	78 78 78	78 78 78	78 78 78	78 78 78	78 78 78	78 78 78	78 78 78	78 78 78	78 78 78	78 78	78 78	78
9 9	9 9	9 9 9 9	9 9 9 9	9 9 9 9	9 9 9	9 9 9	9 9 9	9 9	9 9 9	9 9 9	9 9 9	9 9 9	9 9 9	9 9 9	9 9 9	9 9 9	9 9 9	9 9 9	9 9	9 9	9
8 8	8 8	8 8 8 8	8 8 8 8	8 8 8 8	8 8 8	8 8 8	8 8 8	8 8	8 8 8	8 8 8	8 8 8	8 8 8	8 8 8	8 8 8	8 8 8	8 8 8	8 8 8	8 8 8	8 8	8 8	8
5 5	5 5	5 5 5 5	5 5 5 5	5 5 5 5	5 5 5	5 5 5	5 5 5	5 5	5 5 5	5 5 5	5 5 5	5 5 5	5 5 5	5 5 5	5 5 5	5 5 5	5 5 5	5 5 5	5 5	5 5	5
12 12	12 12	12 12 12 12	12 12 12 12	12 12 12 12	12 12 12	12 12 12	12 12 12	12 12	12 12 12	12 12 12	12 12 12	12 12 12	12 12 12	12 12 12	12 12 12	12 12 12	12 12 12	12 12 12	12 12	12 12	12

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BOSTON AND MAINE RAILROAD

Exhibit 40

INTERCHANGE AND PER DIEM CARD

BOSTON AND MAINE RAILROAD

Car Initials	Car Number	Kind	Lor E		Per Diem Days	Mo.	Day	Time Hr.	Time Min	Station Received	Station Delivered	Day	Time Hr.	Time Min.	
										c	Printed in U. S. A.		POWERS—8238		
Car Initials	Car Number	Kind	Lor E		Per Diem Days	Mo.	Day	Time Hr.	Time Min.	Station Received	Station Delivered	Day	Time Hr.	Time Min.	

Exhibit 41

PASSENGER CAR CARD

BOSTON AND MAINE RAILROAD

Car Initials	Car Number	Kind	Lor E	Train Number	Mo.	Day	Station Taken	Station Left	Passenger Miles	Other Miles	S. P. & O. Miles	Diner Miles	
									Printed in U. S. A.		POWERS—7525	c	
Car Initials	Car Number	Kind	Lor E	Train Number	Mo.	Day	Station Taken	Station Left	Passenger Miles	Other Miles	S. P. & O. Miles	Diner Miles	

station left, date and time, miles and gross tons. Locomotive cards are punched for ownership, number, date, class of service, principal or helper miles, train switching miles, terminal miles, station to station movement and weight. Following the punching and verification of this information, cards are passed through an interpreting punch which prints a figure along the top margin of the card decoding each card column above the corresponding punched hole.

Freight car cards are passed to a tabulator equipped with a summary punch for preparation of freight train statistics. Tabulation is made of the loaded and empty car miles, net and gross tons, the number of empty and loaded cars taken at each station, and as the station changes, the totals for previous stations are punched into a summary card. Freight car cards are next tabulated for station left and summary cards are punched for net and gross tons and number of loaded and empty cars dropped at each station. Summary cards for stations taken and left are sorted together and tabulated to produce a tape showing date, train symbol number, station net and gross tons, number of loaded and empty cars handled by train between stations, and empty car miles for train. Net and gross tons are multiplied by miles between stations shown by calculating machine and accumulated for the net and gross ton miles of each train. A master card is then punched for train totals. All the master cards of the day are sorted by train symbol number and separated by divisions and direction to produce a daily activity report.

Locomotive cards are punched and tabulated to show the power used on each train. The locomotive cards are also

tabulated in total miles in each class of service, which provides the basis for computing ton-mile statistics.

From the punched interchange cards, a daily tabulation is made of cars received, which is used to establish a quick home route method. A tabulation is also made of foreign cars delivered and is used in pulling per diem cards for use in preparing per diem reports.

The interchange and per diem card is an automatically reproduced card which identifies each foreign railroad freight car on the line at the close of each month. These cards are sorted into a file by car number, ownership disregarded. Interchange cards for cars received the first day of the current month are sorted with the transfer reproduced cards. The list of foreign railroad cars delivered is used as the medium for pulling from this file the transfer or receipt card to correspond with the car reported delivered off the line the first day. Cards pulled for the day are sorted by date received and run through the key punch to gang date of delivery and number of days on the line. Each day cars open on the check list (in absence of a receipt card in the file) are immediately investigated by sending error slips to junction points for interchange corrections. The cards for each day are sorted by road of ownership and filed. When reporting per diem to car owners, cards are sorted in numerical order and tabulated on a per diem form which designates foreign road and car number and totalizes per diem days paid.

All duplicate interchange cards punched for home cars delivered off the line are pulled from a list used for a

quick home route record and are filed when receipt date and number of days off line are punched. At the end of the month, cards are sorted in numerical order and tabulated to show total per diem earned on each car away from the home line. Per diem earnings indicated on reports received from foreign railroads are punched into cards for month, road, car number, and number of days per diem earned. Cars are sorted in numerical order and tabulated to show railroads reporting per diem earned and totals for each car. This list is checked against the list previously made showing total per diem due. Discrepancies are checked against the printed record of junction movements off line punched from daily junction slips.

The passenger car cards are punched from wheel reports issued by conductors to record car initial and number, kind, loaded or empty, train number, station to station move, and miles according to class. After wheel reports for the day are completely punched, cars are sorted by divisions and train number and a list is tabulated to prepare operations by divisions. Cars are then released for passenger car records and are sorted by ownership and filed. At the close of the month, a permanent record is run and foreign passenger car cards are tabulated for mileage earnings to report to car owners.

26.0 Use of Tabulating Machines for Accounting and Statistics by the Interstate Life Insurance Company

26.1 Statement of the Problem

The insurance field represents the most highly specialized market for tabulating machines for several important reasons. While the creation of an insurance policy requires but one initial transaction through the sale of the policy to the insured, the acceptance of the contract creates a multiplicity of transactions over the life of the policy which requires exhaustive need for information of varying sorts. While accounting is purely an internal problem in most industrial businesses, the insurance business must obtain a vast amount of information for activities beyond the internal accounting requirements. The Interstate Insurance Company, of Cleveland, Ohio has ordinary contracts in force at present in excess of $750,000,000 in valuation. It has about 1,300,000 policy holders in its actuarial department and 4,500,000 policy holders in its industrial divisions. It must provide the State of Ohio with minute and exacting details of its existing reserves. For tax purposes, it must account to each state regarding the amount of insurance in force within the boundaries of the state. It must secure a vast amount of data to control the operations of its 275 agencies. A tremendous volume of facts about policy holders must be exchanged with other insurance companies. In the insurance business an individual policy is a changing entity. There are innumerable plans of life insurance

and individual plans are constantly being converted to other plans. The policy holder pays premiums by optional methods. Dividends received by policy holders are applied in different manners. Settlements when policies are terminated are made in optional fashion. The benefits paid differ according to the contract. The degree of insurance risk is a leading factor, with regard to the kind and amount of insurance offered to an accepted applicant and to the complete rejection of a physically unfit person. Policy loans are a major problem, and the application of payments upon loans must be recognized to determine the value of outstanding loans in force. Lapses of insurance premium constitute another leading branch for analysis. Actual mortality rates must be verified against estimated mortality rates to measure the cost of insurance. Mortgage loan accounting is another important phase of the problem. In short, no business is subject to such a wide variation in its basic transactions over so far reaching an array of interwoven problems as the life insurance business. Add to this extreme complexity in the nature and the changing of the individual contract the enormous number of contracts subject to these varying needs and a composite picture of the perplexing problem is obtained. It is such problems as these that emphasize the true worth of punched cards. It may be seen immediately that the most important element for insurance accounting is flexibility. Under the tabulating plan a single card is punched to represent the individual varying transaction affecting the policy. Most insurance

companies, even those of small size, require tabulating machines as a necessary and indispensable means of providing vast amounts of vital information. Without tabulating machines, insurance companies could not function upon so efficient and comprehensive a basis as we find today. Insurance companies were among the leading users of early tabulating machines. Today when new and improved facilities are being constantly offered by the machine producers, hardly a device is created which does not at once invite a leading use in the insurance business. In the following discussion of the ordinary life insurance problem in the actuarial division of the Interstate Life Insurance Company, only a bare indication of the technique is presented.

26.2 Illustration of Card Forms

The following card forms are employed for ordinary life insurance accounting in the Interstate Life Insurance Company:

Exhibit 42 - Ordinary valuation card
Exhibit 43 - Ordinary dividend card
Exhibit 44 - Statistical card
Exhibit 45 - Ordinary mortality card
Exhibit 46 - Standard mortality card
Exhibit 47 - Ordinary termination card
Exhibit 48 - Ordinary double indemnity card (a similar card used for disability)
Exhibit 49 - Annuity valuation card
Exhibit 50 - Annuity dividend card
Exhibit 51 - Lapse analysis card
Exhibit 52 - Summary card - six uses
Exhibit 53 - Loan accounting card

Examination of the card forms indicates that a separate card form is devoted to each major type of insurance problem. It may be noted that the common field of policy

Exhibit 42

Interstate Life Insurance Co.

POLICY NUMBER	ISSUE YR	ISSUE MO	PLAN	AGE	AMOUNT	GROSS PREMIUM	NET PREMIUM	BENEFIT	RATED	AGENCY	STATE	SEX	MEAN RESERVE	AMT CODE	OFFICE YR BIRTH	PAGE NO
0000000	00	00	00	00	0000000	0000000	0000000	00	00	000	00	0	0000000	0	00	00
1111111	11	11	11	11	1111111	1111111	1111111	11	11	111	11	1	1111111	1	11	11
2222222	22	22	22	22	2222222	2222222	2222222	22	22	222	22	2	2222222	2	22	22
3333333	33	33	33	33	3333333	3333333	3333333	33	33	333	33	3	3333333	3	33	33
4444444	44	44	44	44	4444444	4444444	4444444	44	44	444	44	4	4444444	4	44	44
5555555	55	55	55	55	5555555	5555555	5555555	55	55	555	55	5	5555555	5	55	55
6666666	66	66	66	66	6666666	6666666	6666666	66	66	666	66	6	6666666	6	66	66
7777777	77	77	77	77	7777777	7777777	7777777	77	77	777	77	7	7777777	7	77	77
8888888	88	88	88	88	8888888	8888888	8888888	88	88	888	88	8	8888888	8	88	88
9999999	99	99	99	99	9999999	9999999	9999999	99	99	999	99	9	9999999	9	99	99

I.B.M. 526624 ORDINARY VALUATION — 1935 LICENSED FOR USE UNDER PATENT 1,772,492

Exhibit 43

POLICY NUMBER	ISSUE YR	ISSUE MO	PLAN	AGE	AMOUNT	GROSS PREMIUM	OPTION	DIVIDEND	BENEFIT	RATED	AGENCY	STATE	SEX	DIVIDEND	OFFICE YR BIRTH	TERM YR	TERM MO
0000000	00	00	00	00	0000000	0000000	0000000	000	00	00	000	00	0	000000000000000000000	00	00	00
1111111	11	11	11	11	1111111	1111111	1111111	111	11	11	111	11	1	111111111111111111111	11	11	11
2222222	22	22	22	22	2222222	2222222	2222222	222	22	22	222	22	2	222222222222222222222	22	22	22
3333333	33	33	33	33	3333333	3333333	3333333	333	33	33	333	33	3	333333333333333333333	33	33	33
4444444	44	44	44	44	4444444	4444444	4444444	444	44	44	444	44	4	444444444444444444444	44	44	44
5555555	55	55	55	55	5555555	5555555	5555555	555	55	55	555	55	5	555555555555555	55	55	55
6666666	66	66	66	66	6666666	6666666	6666666	666	66	66	666	66	6	666666666666666	66	66	66
7777777	77	77	77	77	7777777	7777777	7777777	777	77	77	777	77	7	777777777777777	77	77	77
8888888	88	88	88	88	8888888	8888888	8888888	888	88	88	888	88	8	888888888888888	88	88	88
9999999	99	99	99	99	9999999	9999999	9999999	999	99	99	999	99	9	999999999999999	99	99	99

I.B.M. 526520 LICENSED FOR USE UNDER PATENT 1,772,492 ORDINARY DIVIDEND 193

Exhibit 44

INTERSTATE LIFE INSURANCE CO.

POLICY NUMBER	ISSUE YR	ISSUE MO	PLAN	AGE	AMOUNT	GROSS PREMIUM	NET SINGLE PREMIUM OPTION	NET SINGLE PREMIUM EXTRA PREMIUM	BENEFIT	RATED	AGENCY	STATE	SEX	PAY T	RATED CODE	RATED $	RATED YPS OR $	RATED OTHER	INS	SINGLE PREMIUMS LIFE 5 PREMIUM	SINGLE PREMIUMS END 5 PREMIUM	SINGLE PREMIUMS D.I. GROSS SINGLE PREMIUM	SINGLE PREMIUMS EXTRA PREMIUM	TERM MODE	TERM YEAR	TERM MONTH
0000000	00	00	00	00	0000000	0000000	0000000	000	00	00	000	00	0	0	0	0	0	0	0	000000	000000	000000	000000	0	00	00
1111111	11	11	11	11	1111111	1111111	1111111	111	11	11	111	11	1	1	1	1	1	1	1	111111	111111	111111	111111	1	11	11
2222222	22	22	22	22	2222222	2222222	2222222	222	22	22	222	22	2	2	2	2	2	2	2	222222	222222	222222	222222	2	22	22
3333333	33	33	33	33	3333333	3333333	3333333	333	33	33	333	33	3	3	3	3	3	3	3	333333	333333	333333	333333	3	33	33
4444444	44	44	44	44	4444444	4444444	4444444	444	44	44	444	44	4	4	4	4	4	4	4	444444	444444	444444	444444	4	44	44
5555555	55	55	55	55	5555555	5555555	5555555	555	55	55	555	55	5	5	5	5	5	5	5	555555	555555	555555	555555	5	55	55
6666666	66	66	66	66	6666666	6666666	6666666	666	66	66	666	66	6	6	6	6	6	6	6	666666	666666	666666	666666	6	66	66
7777777	77	77	77	77	7777777	7777777	7777777	777	77	77	777	77	7	7	7	7	7	7	7	777777	777777	777777	777777	7	77	77
8888888	88	88	88	88	8888888	8888888	8888888	888	88	88	888	88	8	8	8	8	8	8	8	888888	888888	888888	888888	8	88	88
9999999	99	99	99	99	9999999	9999999	9999999	999	99	99	999	99	9	9	9	9	9	9	9	999999	999999	999999	999999	9	99	99

I.B.M. 526625 LICENSED FOR USE UNDER PATENT 1,772,492 ISSUE 1935

INTERSTATE LIFE INSURANCE CO.

Exhibit 45

CLAIM NUMBER	PLAN	AGENCY	STATE	REGULAR INSURANCE: INCURRED AMOUNT	AMOUNT PAID	NET LOSS	ADDITIONS: AMT	N.L.	AT DEATH: YEAR	AGE	DUR	CAUSE	OCCUP	POLICY NUMBER	F. OR C.M. EXT: AMT / N.L.	RATED YRS. $	ADD'N'L CLAIMS
0 0 0 0 0 0	0 0 0 0	0 0 0	0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0	0 0	0 0	0 0 0 0	0 0	0 0 0 0 0 0	0 0	0 0	
1 1 1 1 1 1	1 1 1 1	1 1 1	1 1	1 1 1	1 1 1	1 1 1			1 1	1 1	1 1	1 1 1 1	1 1	1 1 1 1 1 1	1 1	1 1	
2 2 2 2 2 2	2 2 2 2	2 2 2	2 2	2 2 2	2 2 2	2 2 2			2 2	2 2	2 2	2 2 2 2	2 2	2 2 2 2 2 2	2 2	2 2	
3 3 3 3 3 3	3 3 3 3	3 3 3	3 3	3 3 3	3 3 3	3 3 3			3 3	3 3	3 3	3 3 3 3	3 3	3 3 3 3 3 3	3 3	3 3	
4 4 4 4 4 4	4 4 4 4	4 4 4	4 4	4 4 4	4 4 4	4 4 4			4 4	4 4	4 4	4 4 4 4	4 4	4 4 4 4 4 4	4 4	4 4	
5 5 5 5 5 5	5 5 5 5	5 5 5	5 5	5 5 5	5 5 5	5 5 5			5 5	5 5	5 5	5 5 5 5	5 5	5 5 5 5 5 5	5 5	5 5	
6 6 6 6 6 6	6 6 6 6	6 6 6	6 6	6 6 6	6 6 6	6 6 6			6 6	6 6	6 6	6 6 6 6	6 6	6 6 6 6 6 6	6 6	6 6	
7 7 7 7 7 7	7 7 7 7	7 7 7	7 7	7 7 7	7 7 7	7 7 7			7 7	7 7	7 7	7 7 7 7	7 7	7 7 7 7 7 7	7 7	7 7	
8 8 8 8 8 8	8 8 8 8	8 8 8	8 8	8 8 8	8 8 8	8 8 8			8 8	8 8	8 8	8 8 8 8	8 8	8 8 8 8 8 8	8 8	8 8	
9 9 9 9 9 9	9 9 9 9	9 9 9	9 9	9 9 9	9 9 9	9 9 9			9 9	9 9	9 9	9 9 9 9	9 9	9 9 9 9 9 9	9 9	9 9	

LICENSED FOR USE UNDER PATENT 1,772,492

INTERSTATE LIFE INSURANCE CO.

Exhibit 46

POLICY NUMBER	ISSUE YR	ISSUE M	PLAN	ISSUE AGE	AMOUNT	CLAUSE NUMBER: BI	DI	OCCUPATION	BIRTH	MENT	WEIGHT	BENEFIT	RATE	AGENCY	STATE	SEX	RACE	BUILD	TRUE AGE	PAN PINT	CLASS	BLOOD PRESSURE: SYST.	DIAST	RATED: YRS $	%	IMPAIRMENT	IMPAIRMENT	CHANGE	EXIT: YEAR	MONTH	DURATION	CAUSE OF DEATH
0 0 0 0 0 0	0 0	0 0	0 0 0	0 0	0 0 0	0 0	0 0	0 0 0	0 0	0 0	0 0	0 0	0 0	0 0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0 0 0	0 0 0 0	0 0	0 0	0 0	0 0	0 0 0 0
1 1 1 1 1 1	1 1	1 1	1 1 1	1 1	1 1 1	1 1	1 1	1 1 1	1 1	1 1	1 1	1 1	1 1	1 1 1	1 1	1 1	1 1	1 1	1 1	1 1	1 1	1 1	1 1	1 1	1 1	1 1 1 1	1 1 1 1	1 1	1 1	1 1	1 1	1 1 1 1
2 2 2 2 2 2	2 2	2 2	2 2 2	2 2	2 2 2	2 2	2 2	2 2 2	2 2	2 2	2 2	2 2	2 2	2 2 2	2 2	2 2	2 2	2 2	2 2	2 2	2 2	2 2	2 2	2 2	2 2	2 2 2 2	2 2 2 2	2 2	2 2	2 2	2 2	2 2 2 2
3 3 3 3 3 3	3 3	3 3	3 3 3	3 3	3 3 3	3 3	3 3	3 3 3	3 3	3 3	3 3	3 3	3 3	3 3 3	3 3	3 3	3 3	3 3	3 3	3 3	3 3	3 3	3 3	3 3	3 3	3 3 3 3	3 3 3 3	3 3	3 3	3 3	3 3	3 3 3 3
4 4 4 4 4 4	4 4	4 4	4 4 4	4 4	4 4 4	4 4	4 4	4 4 4	4 4	4 4	4 4	4 4	4 4	4 4 4	4 4	4 4	4 4	4 4	4 4	4 4	4 4	4 4	4 4	4 4	4 4	4 4 4 4	4 4 4 4	4 4	4 4	4 4	4 4	4 4 4 4
5 5 5 5 5 5	5 5	5 5	5 5 5	5 5	5 5 5	5 5	5 5	5 5 5	5 5	5 5	5 5	5 5	5 5	5 5 5	5 5	5 5	5 5	5 5	5 5	5 5	5 5	5 5	5 5	5 5	5 5	5 5 5 5	5 5 5 5	5 5	5 5	5 5	5 5	5 5 5 5
6 6 6 6 6 6	6 6	6 6	6 6 6	6 6	6 6 6	6 6	6 6	6 6 6	6 6	6 6	6 6	6 6	6 6	6 6 6	6 6	6 6	6 6	6 6	6 6	6 6	6 6	6 6	6 6	6 6	6 6	6 6 6 6	6 6 6 6	6 6	6 6	6 6	6 6	6 6 6 6
7 7 7 7 7 7	7 7	7 7	7 7 7	7 7	7 7 7	7 7	7 7	7 7 7	7 7	7 7	7 7	7 7	7 7	7 7 7	7 7	7 7	7 7	7 7	7 7	7 7	7 7	7 7	7 7	7 7	7 7	7 7 7 7	7 7 7 7	7 7	7 7	7 7	7 7	7 7 7 7
8 8 8 8 8 8	8 8	8 8	8 8 8	8 8	8 8 8	8 8	8 8	8 8 8	8 8	8 8	8 8	8 8	8 8	8 8 8	8 8	8 8	8 8	8 8	8 8	8 8	8 8	8 8	8 8	8 8	8 8	8 8 8 8	8 8 8 8	8 8	8 8	8 8	8 8	8 8 8 8
9 9 9 9 9 9	9 9	9 9	9 9 9	9 9	9 9 9	9 9	9 9	9 9 9	9 9	9 9	9 9	9 9	9 9	9 9 9	9 9	9 9	9 9	9 9	9 9	9 9	9 9	9 9	9 9	9 9	9 9	9 9 9 9	9 9 9 9	9 9	9 9	9 9	9 9	9 9 9 9

INTERSTATE LIFE INSURANCE CO.

Exhibit 47

DUR	P.U. CC M	POLICY NUMBER	ISSUE YR	ISSUE M	PLAN	AGE	FULL AMOUNT	BENEFIT	RATED	AGENCY	STATE	SEX	TERMINATION YEAR	M	DUR	PAID UP AMOUNT	TERMINAL RESERVE	C.V. APPD.	INDEBT.	MEAN RESERVE	YR. BR.	YR. MAT
0 0			0 0	0	0 0 0	0 0	0 0 0	0 0	0 0	0 0 0	0 0	0 0	0 0	0 0	0 0	0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0	0 0
1 1		T REC	1 1	1	1 1 1	1 1	1 1 1	1 1	1 1	1 1 1	1 1	1 1	1 1	1 1	1 1	1 1 1	1 1 1 1	1 1 1 1	1 1 1 1	1 1 1 1	1 1	1 1
2 2		C.V. APPD.	2 2	2	2 2 2	2 2	2 2 2	2 2	2 2	2 2 2	2 2	2 2	2 2	2 2	2 2	2 2 2	2 2 2 2	2 2 2 2	2 2 2 2	2 2 2 2	2 2	2 2
3 3		INDEBT.	3 3	3	3 3 3	3 3	3 3 3	3 3	3 3	3 3 3	3 3	3 3	3 3	3 3	3 3	3 3 3	3 3 3 3	3 3 3 3	3 3 3 3	3 3 3 3	3 3	3 3
4 4		C.V	4 4	4	4 4 4	4 4	4 4 4	4 4	4 4	4 4 4	4 4	4 4	4 4	4 4	4 4	4 4 4	4 4 4 4	4 4 4 4	4 4 4 4	4 4 4 4	4 4	4 4
5 5		RES REL.	5 5	5	5 5 5	5 5	5 5 5	5 5	5 5	5 5 5	5 5	5 5	5 5	5 5	5 5	5 5 5	5 5 5 5	5 5 5 5	5 5 5 5	5 5 5 5	5 5	5 5
6 6			6 6	6	6 6 6	6 6	6 6 6	6 6	6 6	6 6 6	6 6	6 6	6 6	6 6	6 6	6 6 6	6 6 6 6	6 6 6 6	6 6 6 6	6 6 6 6	6 6	6 6
7 7		M. RES.	7 7	7	7 7 7	7 7	7 7 7	7 7	7 7	7 7 7	7 7	7 7	7 7	7 7	7 7	7 7 7	7 7 7 7	7 7 7 7	7 7 7 7	7 7 7 7	7 7	7 7
8 8		YR. BIRTH	8 8	8	8 8 8	8 8	8 8 8	8 8	8 8	8 8 8	8 8	8 8	8 8	8 8	8 8	8 8 8	8 8 8 8	8 8 8 8	8 8 8 8	8 8 8 8	8 8	8 8
9 9		YR. MAT.	9 9	9	9 9 9	9 9	9 9 9	9 9	9 9	9 9 9	9 9	9 9	9 9	9 9	9 9	9 9 9	9 9 9 9	9 9 9 9	9 9 9 9	9 9 9 9	9 9	9 9

I.B.M 523388 ORDINARY TERMINATION CARD LICENSED FOR USE UNDER PATENT 1,772,492

Exhibit 49

INTERSTATE LIFE INSURANCE CO.

NPF NP | B 12 ISSUE | SEX | PREM PAID | RATE | PLAN | AGE AT RETIREMENT | YRS DEF | PAYMENTS BEGIN | AGE | B | YEARLY PAYMENT | 8 NET PREMIUM 8 | P.U. DATE | DURATION YRS MOS | 12 TER | DS | PAGE NO.

X ANNUITY NUMBER | YR M | M S | F A | 2L SA | 3L Q | M | PU | R | Q | SD | ORIGINAL NUMBER | YRS M | X | SA | Q | M | ANNUITY PAID | GROSS PREMIUM | AGENCY | STATE | DIS | 35 40 45 | 36 41 46 | 37 42 47 | 38 43 48 | 39 44 49 | YIM | L | NP | PU | S | E | R | NP | C | NT | D

IBM 526523 ANNUITY VALUATION 1935 LICENSED FOR USE UNDER PATENT 1772 492

Exhibit 48

INTERSTATE LIFE INSURANCE CO.

POLICY NUMBER | 12 ISSUE YR. M | PLAN X X | AGE | X AMOUNT | DOUBLE INDEMNITY CLAUSE NO. | GROSS PREMIUM | PREMIUM CEASE | PLAN CODE | YEAR ADDED | AGE GROUP | BENEFIT | RATED | AGENCY | STATE | SEX M F | BENEFIT CEASE | CLASS | MEAN RESERVES 36 42 48 | 37 43 49 | 38 44 50 | 39 45 51 | 40 46 52 | 41 47 53 | DURATION | YEAR | MONTH

IBM 529241

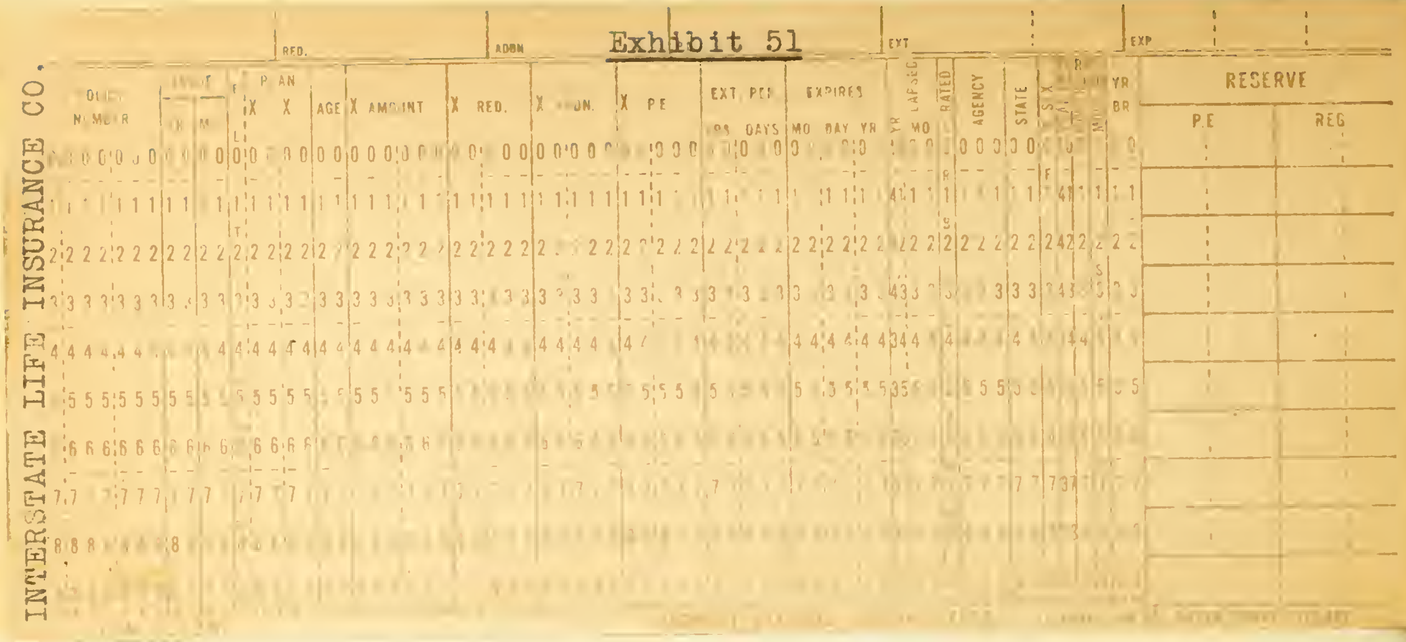
Exhibit 50

NPF NP | B 12 ISSUE | SEX | PREM PAID | RATE | PLAN | AGE AT RETIREMENT | YRS. DEF. | PAYMENTS BEGIN | AGE | B | YEARLY PAYMENT | 8 NET PREMIUM 8 | P.U. DATE | DURATION YRS. MOS. | C.V. AP. | RESERVE | C.V. PD. | C.V. AP. | 12 TER | DS | 20 DUR.

X ANNUITY NUMBER | YR M | M S | F A | 2L SA | 3L Q | M | PU | R | Q | SD | ORIGINAL NUMBER | YRS M | X | SA | Q | M | ANNUITY PAID | GROSS PREMIUM | AGENCY | STATE | DIS | 36 41 46 | 37 42 47 | 38 43 48 | 39 44 49 | 40 45 50 | YIM | L | RP | PU | S | E | R | NP | C | NT | D

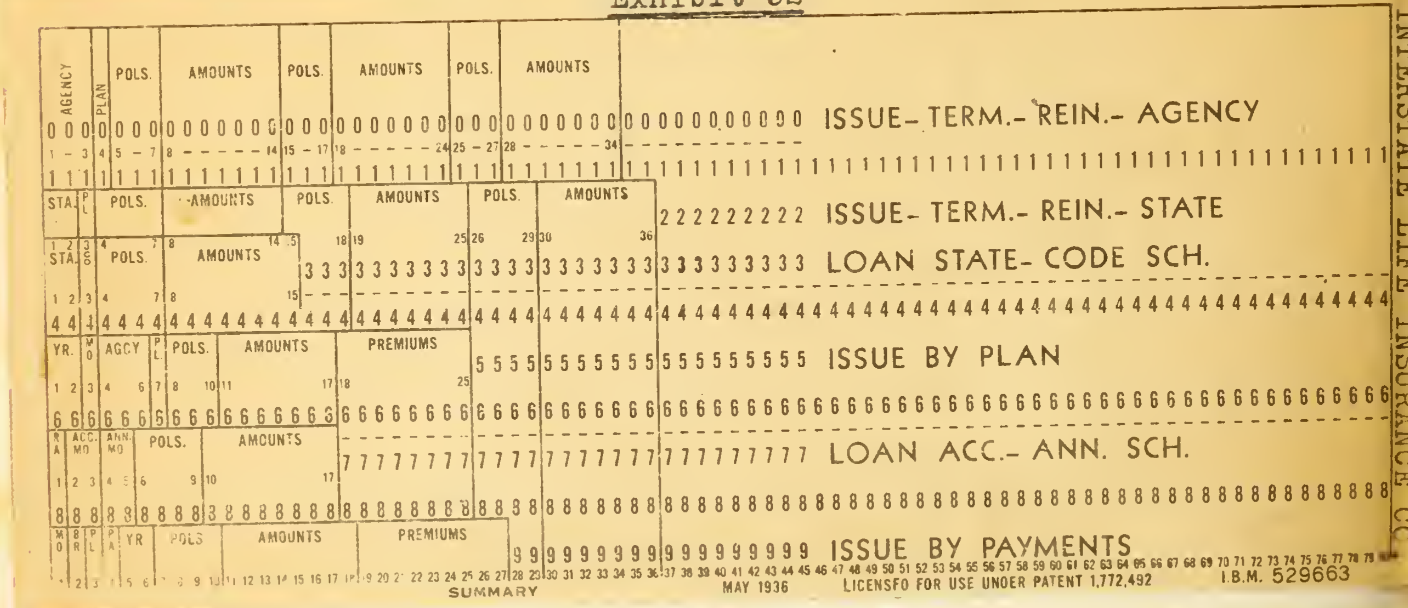
IBM 526522 ANNUITY DIVIDEND 1935 LICENSED FOR USE UNDER PATENT 1772 492

Exhibit 51



INTERSTATE LIFE INSURANCE CO.

Exhibit 52



ISSUE-TERM.-REIN.-AGENCY

ISSUE-TERM.-REIN.-STATE

LOAN STATE-CODE SCH.

ISSUE BY PLAN

LOAN ACC.-ANN. SCH.

ISSUE BY PAYMENTS

SUMMARY

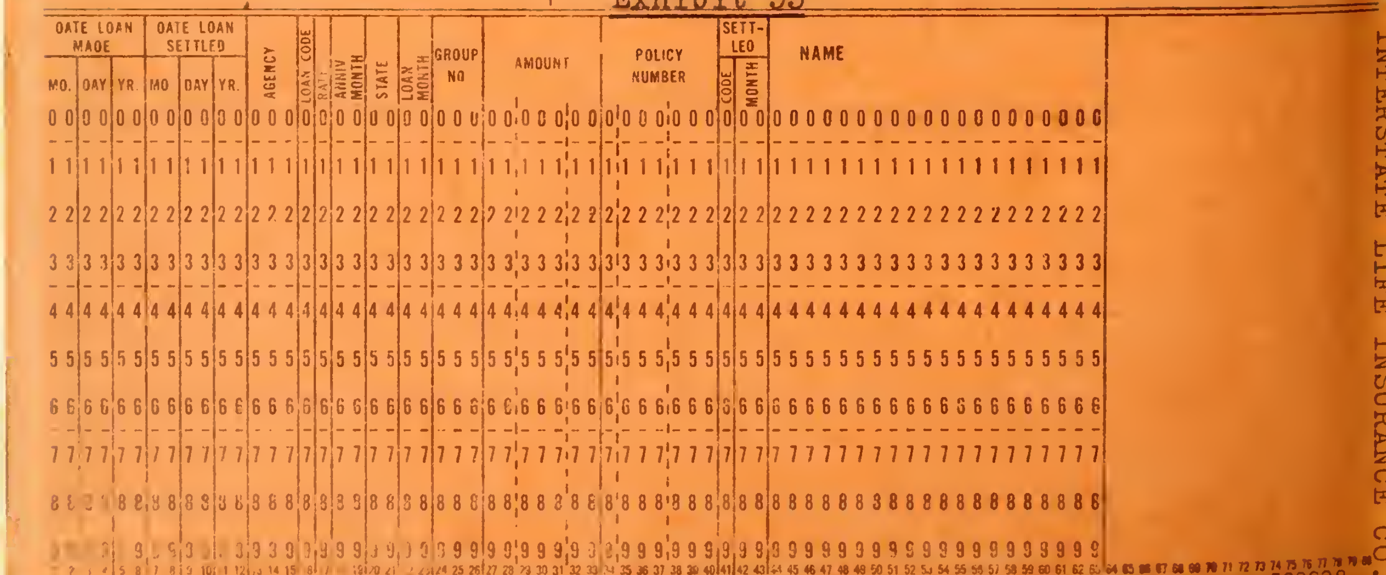
MAY 1936

LICENSED FOR USE UNDER PATENT 1,772,492

I.B.M. 529663

INTERSTATE LIFE INSURANCE CO.

Exhibit 53



POLICY LOAN CARD - AUDITING DEPT.

LICENSED FOR USE UNDER PATENT 1,772,492 1935 I.B.M 526628

INTERSTATE LIFE INSURANCE CO.

number identifies all the cards, which permits the arrangement of all tabulating card files for respective purposes in numerical sequence of policy number. Two outstanding requirements for individual machine units are presented immediately. In order to permit flexible transfer of information from one insurance card to another, the comparing reproducer is demanded. The reproducing feature permits the transfer of punched data from any column of the setup card to any column of the reproduced card; the comparing feature causes the machine to stop whenever the transferred information in the reproduced card does not exactly correspond. The automatic and positively verified reproducing curtails to only a few fields those columns which must be manually punched and verified from the source for punching the reproduced card. The second requirement is for the interpreting punch, by means of which passage of punched cards through the machine provides a printed character across the top of the card to decode the corresponding punched hole above the column punched. The printed characters permit easy reference and identification.

26.3 Origin of Insurance Card Files

Applications for new business are received from the 275 agencies daily. These applications are investigated and are approved, revised for approval according to plan, amount, and kind of risk, or rejected. The approved applications are sent to coding clerks who originate a coding sheet (Appendix Form 13) which is used as the basis for originating four fundamental insurance cards for valuation reserve, dividend, statis-

tical, and mortality purposes. Inasmuch as the accurate recording of information from the source code sheet is infinitely important because of the transfer of the punched data into other cards, especial care is taken to ensure the correct coding and punching of the original records. The coding function is performed by parallel check. On the coding sheet one horizontal line is used to classify each insurance policy completely. Each ordinary code sheet, which is used on both sides, permits the coding of forty policies. Two separate code sheets are originated from each group of applications. The chief clerk assigns a numerical serial number to each accepted application and passes groups of applications, representing forty policies each, to original coders, who complete the manual coding of the specifications of each contract by pencil notations in the columns provided. The original coding clerks enter the serial number of the policy in red. As soon as the code sheet is completed for original coding, the forty applications are handed to a check coding clerk who originates a new coding sheet, entering the serial numbers in black, and independently originates a complete check coding from the forty applications. The red series code sheet is read back against the black series code sheet to eliminate any errors that were made in the independent coding operation. This check, although positive, is not accepted as final. Two sets of valuation reserve cards are punched from the red and black series code sheets, respectively. In order to obtain perfect accuracy in check of both the coding

and the punching operations, the cards punched from the red series are verified with cards from the black series by running both sets of the cards through the comparing reproducer. This establishes that the cards must be correct. The code sheet provides the following data: policy number, issue month and year, plan, valuation age, policy amount, premium, class of benefit, risk rating, agency, state, sex, disability (and/or double indemnity) premium, occupation, girth, height, weight, race, build, true age, family history, type, class, blood pressure, reserve rating, impairments, and other insurance code. This information is imposing in its positive identification of the individual with the terms of the contract. By using the ordinary code sheet as a punching medium, the four basic files for valuation, dividends, statistics, and mortality are set up by a combination of reproduced and manual punching. When completed, all original cards are interpreted and filed by policy number.

It is not within the scope of this thesis to trace the sequence of use of each basic card form in its relation to the other cards for satisfying specific requirements; such a study would be voluminous and would require a special technical investigation in the insurance business. It is rather the purpose here to specify broadly that the information recorded into subsequent cards for definite transactions is obtained by pulling a base card providing associated policy data for use in combination with manually punched facts of the individual case to record the new card completely. This applies

whether involving loan, lapse, mortality, termination or other transaction. The purpose here is to mention the determination of insurance reserve requirement, the establishment of control in the Group Register, and to indicate the type of ultimate information demanded in reports.

26.4 Maintenance of Control by the Group Register

Every coded life insurance policy which is represented by a proven valuation card is posted under its proper classification in any of 600 insurance ledgers. The ledgers are divided according to plan group, year group, and age group. The Group Register is in the nature of a controlling account over the ledgers and shows for each plan, year, and age group the number of policies in force, their value, the gross premiums, the net premiums, and the mean reserves. The Group Register may be maintained both by policy classes and refined under policy classes to show page totals in the ledgers. Policies are being added and removed from the records daily, and it is necessary to tabulate an activity sheet daily which shows the net change in page content.

The State of Ohio requires an exact control over the page content of each insurance ledger in order to verify constantly that adequate legal reserves are maintained to support insurance in force. The State Department of Insurance maintains a detailed control over the ledgers of the Interstate Life Insurance Company, and not only makes an annual audit of the company's ledgers to verify correctness of the two sets of books as of October 31, but also requires supplementary

reports of interim changes which are posted to the records of the State to maintain daily balance. It takes two weeks for the annual inspection during which each ledger must be brought to the State and inspected for exactness of each page in each ledger. A tolerance of $10.00 in reserve variance will be accepted by the State for any page total. Larger differences must be investigated and corrections made.

Mean reserves are determined by the Interstate Company by running valuation cards through the multiplying punch as necessary. A fixed multiplier is used to extend each class of policy and extension fields must be planned in relation to the policy year of expiration. Each valuation card has provision for five extension fields for recording the accumulated reserve on an annual basis for five years. At the end of the five year period, the entire file of policies entering the sixth year must be reproduced into a new file, which is used for extending the accumulative reserve set up in the next five years. Thus, if a 30 pay life contract endures until maturity, the original valuation file will have been reproduced at least six times. Dividend cards are likewise extended by multiplier, both on a quarterly and on an annual basis. Since the quarterly mode of premium payment is the most frequent, dividend card files must be reproduced often.

26.5 Monthly Ordinary Life Insurance Reports

The major divisions for which reports must be prepared monthly are the Group Register, the States and the

Agencies. The most vital report of all is the Business in Force tabulation, which is analyzed to show both new business written, old business continued, lapses, and terminations. Monthly reports are prepared for analyzing issues, premium income, dividends, loans, lapses, terminations and for various statistical and other purposes. The indicating fields are wired to represent the identifying data of the report prepared and the adding fields show by plan group the number of policies, the gross valuation, the gross premium, the net premium, or the mean reserve amount in relation to other specific adding fields.

For sake of illustration, the New Business report is prepared for all new contracts written for the month, both by State and by Agency. Terminations are likewise tabulated for the month by State and by Agency; these cards are X-punched for direct subtraction. The addition and the deduction cards representing the month's policy activity are grouped with the summary cards representing business in force at the end of the previous month, and a Business in Force report as at the close of the current month is run by State, by Agency, with simultaneous punching of balance forward summary cards. Another monthly statement of Business in Force is run for the Group Register, to show total summary of policies by plan group, year, and age, showing amounts, premium, and reserve. A monthly statement of Issues is made by method of payment. A further monthly statement of Issues is run by benefits, showing amounts for single indemnity, double indemnity, and disability, or

combinations of the three.

A second group of monthly reports is prepared to analyze Policy Loans, classified according to interest rate of 5 or 6 per cent. One tabulation is run to show totals by anniversary month by rate of interest. Another report is prepared to produce totals by loan month by rate of interest. Loans by States and agencies are provided by other distributions. Still another summary is furnished to classify loans by class. A final report is run to show payments made upon loans by kind of settlement.

An extensive group of reports is compiled for analysis of Terminations. A monthly distribution of terminations by agencies is computed. A schedule of terminations by States is summarized. A statistical classification of terminations by causes is obtained, whether for death, lapses, cash surrender, or other reason. A special breakdown of lapses by agencies is tabulated in an effort to measure the relationship of the date of lapse to the date of issue.

Similarly, periodic reports are provided for analysis of dividend records, mortality, and other insurance activity. A multitude of transactions arise daily which affect reserve. Individual policy holders are continually revising their insurance plans to suit their current needs. A subscriber may wish to increase a $10,000 ordinary life policy to an amount of $25,000. On the other hand he may order a reduction of the face amount of a 20 pay life policy from $10,000 to $5,000. Or again, he may wish to convert

an annuity on which he has paid for eight years to an endowment or an ordinary life contract.

26.6 Summary

Annual reports are tabulated for most insurance activities, usually from summary cards obtained simultaneously with running of monthly tabulations. Much statistical information must be provided, both of regular nature and for special studies. It is evident that the most important requisite of a system for fulfilling insurance accounting and statistical needs is flexibility. Since each individual contract is subject to so many ramifications of activity or change, and since the number of transactions is so voluminous, punched cards represent the only efficient, economical, and accurate means of satisfying all purposes on so large a scale. Under the tabulating plan, an individual punched card is prepared to represent the policy in its particular variation. Because of this flexibility the entire insurance problem may be decentralized into its individual phases, and each phase may be dealt with separately by use of automatic accounting machinery, which overcomes the element of complexity. The Interstate Life Insurance Company uses the following tabulating machines for actuarial work:

5 Numeric Duplicating Key Punches
3 Alphabetic Printing Punches
4 Numeric Punches
2 Numeric Interpreters
1 Alphabetic Interpreter
2 Reproducers
1 Multiplier

10 Sorters
5 7 Bank Numeric Tabulators
3 Alphabetic Tabulators
1 High Speed Summary Punch
5 Alphabetic Summary Punches

The foregoing list of equipment is mentioned both as an implication of the exceptional complexity of the insurance problem and of the specialized nature of the use of punched cards in the insurance field. There are 1,300,000 policy holders represented in the actuarial division of the Interstate Life Insurance Company, but since many insurance functions require the use of a separate distinctive card to record the activity, several million tabulating cards are necessary to store all the important facts affecting the individual contracts. Without the use of punched cards, much of the information available on a comprehensive basis today would be limited or lacking entirely.

27.0 Government Application of Punched Cards by the Massachusetts Unemployment Insurance Commission

27.1 The Need for Tabulating Equipment by the Unemployment Insurance Commission

By Statute of the Commonwealth of Massachusetts, all employers of more than eight persons, in those businesses included under Social Security Law, and all employees who work for such employers are eligible for unemployment insurance tax upon wages earned. A deduction of 1 percent is withheld from each employee's wages by the employer, regardless of period of payment, up to the point when gross earnings of a six months period exceed $1250.00. Each employer is liable for a corre-

sponding tax upon the total payroll. Every month, each employer remits to the State a check which represents a tax of 1.9% upon the gross amount of each monthly payroll and which includes both the employer's and the employees' contributions. As of January 1, 1939, 30,000 employers of more than 4 persons each will be paying unemployment compensation taxes to the State monthly to cover contributions made by 1,800,000 employees who work in Massachusetts. This is a huge task, for the tax collections of employers must be posted monthly to an employers' ledger and the earnings upon which tax is based must by punched into employees' ledger cards quarterly. The real issue involved in accounting for 30,000 employers and 1,800,000 employees lies in the repetitive nature of the posting and the maintenance of the activity of both employers and employees in respective ledgers over a period of years. Administration of Social Security is a gigantic problem when judged in terms of the enormous volume of detail caused by the recording of all transactions throughout the years. The Unemployment Compensation Commission of Massachusetts will use more than 25,000,000 tabulating cards in 1939, which provides a measure of the volume of transactions encountered.

The most important problem of the United States Government in Social Security administration, aside from the procedure of originating adequate records for reporting employer taxes and employees earnings, was to determine an adequate method for frequent posting and balance forwarding of

control ledgers on an extremely flexible basis. Manually operated bookkeeping machines did not suit the requirement because of the tremendous labor involved in sorting, filing, pulling, posting, balance forwarding and refiling; this application would result in a slow, costly process, difficult to control. The problem was furthermore complicated by the knowledge that individual employees would in many instances change employers several times over a period of months or years, causing interchange of accounts between ledgers. Another main consideration was the establishment of a system that would interweave the problems of tax collection, ledger posting, claims, benefit payment, and statistics without causing extensive duplication of records.

The task was inherently a job for punched cards purely from consideration of sheer magnitude, and the entire problem of both Federal and State Administration was solved by use of International tabulating machines. It was recognized that use of acknowledged tabulating machine principles would accomplish the automatic consolidation of the entire routine, with absolute flexibity in accounting for exceptions. Furthermore, the International Company knew what to offer to the United States Government because of its prior installation of tabulating machines for Social Security use in Italy. The main obstacle in the entire question was eliminated by the International Company in the development of the collator, a special machine for solving the problem of posting to card ledgers on a completely automatic basis.

The main consideration before the Government had been the posting of monthly and quarterly figures to control ledgers without resorting to slow and costly manual methods. It was desired to post the employer results of each period on both a current and a cumulative basis, requiring extensive pulling and filing of cards. The International Collator is a machine with two card feeds which permits automatic shuffling in perfect numerical sequence of two sets of cards which are numerically sorted to a common field. The collator solved the filing problem in both the employer and the employee ledgers. Tabulating card ledgers are maintained both for employer and employee activity. The employers' card files are arranged by employer account number and the employees' file is set up by registration number. Each month and quarter it becomes necessary to punch cards for employers' contributions and employees' earnings, respectively. These current proven cards must be filed by account number into the ledgers, which contain card records of all amounts reported in prior periods. The automatic filing operation in numerical sequence is accomplished by combined use of the sorting machine and the collator, which ensure speedy, economical and accurate results.

27.2 Tabulating Card Forms

The Unemployment Compensation Commission is concerned with five major functions as follows:

(a) Accounting for employers' monthly tax contributions
(b) Maintain records of employee quarterly earnings
(c) Provide for filing of benefit claims through local offices and payment of benefits by the main office

for claims accepted.
(d) Rendering employment service.
(e) Statistical analysis of how the plan works.

Because of the newness of the undertaking the Commission has concerned itself so far mainly with the first three stages of the work. The following list of card forms comprises the main electro-types which are being employed at present:

Exhibit 54 - Employer detail and summary contribution card.
Exhibit 55 - Employer contribution ledger
Exhibit 56 - Employee master card
Exhibit 57 - Employee quarterly wage card
Exhibit 58 - Employee claim card
Exhibit 59 - Employee benefit authorization card.

The individual card forms are used in many striped colors according to the purpose desired. Especial attention is directed to the use of many of the tabulating card forms as dual original records. It may also be noted that the top line of several of the cards is spaced into fields for automatic decoding of the punched holes by characters printed from the alphabetic interpreter.

27.3 Accounting for Employer Contributions

Employers report monthly on forms provided by the State the gross amount of the monthly payroll and enclose checks for 1.9 percent of the payroll as unemployment insurance tax. The amount of tax remitted represents the combined contributions of employer and employees, and the total contributions of each are noted separately on the form. The earnings and tax amounts are broken down by weeks on the form, to permit posting directly from the employer's records.

Exhibit 54

MASS. UNEMPLOYMENT COMPENSATION COMM.

EMPLOYER NO

DATE REC'D	EMPLOYER CONTRIBUTION	EMPLOYEE CONTRIBUTION	INTERES	TOTAL	ACCOUNTS RECEIVABLE
3	3	3	3	3	
4	4	4	4	4	

EMPLOYER NUMBER | EMPLOYER NAME

6	6	6	6	6	
7	7	7	7	7	
8	8	8	8	8	
9	9	9	9	9	

TRANSACTION	CARD COLOR
CONTRIBUTION	MANILA
SUMMARY	SALMON
ACCTS REC. DEBIT	GREEN
ACCTS REC. CREDIT	RED
REFUND VOUCHER	BLUE
CHARGE VOUCHER	YELLOW
JOURNAL VOUCHER	BROWN

736 LICENSED FOR USE UNDER PATENT 1772 92

Exhibit 55

EMPLOYER LEDGER

MONTH COV'D.	DATE REC'D. MO.	DAY	YR.	CASH RECEIVED: EMPLOYER CONTRIBUTIONS	EMPLOYEE CONTRIBUTIONS	INTEREST	TOTAL	EMPLOYER NO

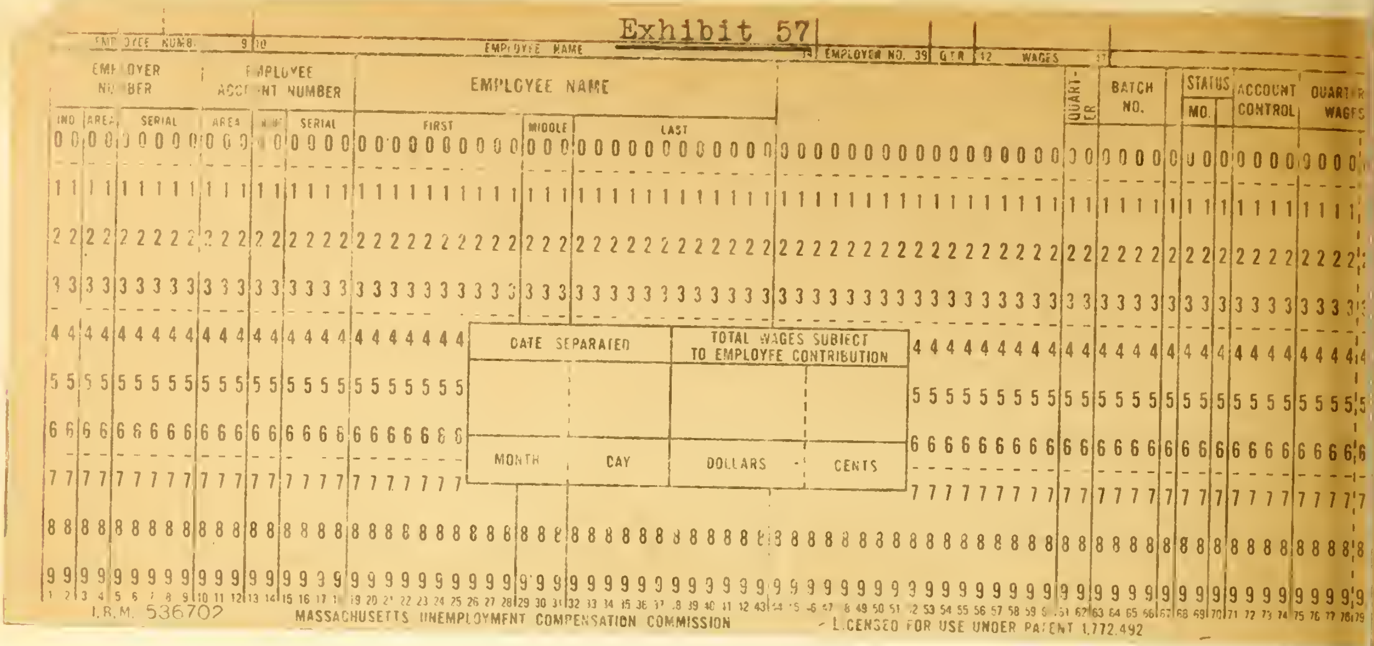
Exhibit 56

EMPLOYEE ACCOUNT NO. | EMPLOYEE NAME

EMPLOYEE ACCOUNT NO. EA	GR.	SERIAL	EMPLOYER NAME FIRST	MIDDLE	LAST	INDEX CODE	DATE OF BIRTH MO.	DAY	YR.	DATE ISSUED MO.	DAY	YR.
0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9	9	9	9

FORM BC-204 6-37 EMPLOYEE MASTER CARD – SOCIAL SECURITY BOARD LICENSED FOR USE UNDER PATENT 772,492 L.G.M. 5-507a

Exhibit 57



EMPLOYEE NUMB. 9 10 | EMPLOYEE NAME | EMPLOYER NO. 39 | QTR 42 | WAGES

EMPLOYER NUMBER: IND. AREA SERIAL

EMPLOYEE ACCOUNT NUMBER: AREA GR. SERIAL

EMPLOYEE NAME: FIRST MIDDLE LAST

QUARTER

BATCH NO.

STATUS: MO.

ACCOUNT CONTROL

QUARTER WAGES

DATE SEPARATED: MONTH DAY

TOTAL WAGES SUBJECT TO EMPLOYEE CONTRIBUTION: DOLLARS CENTS

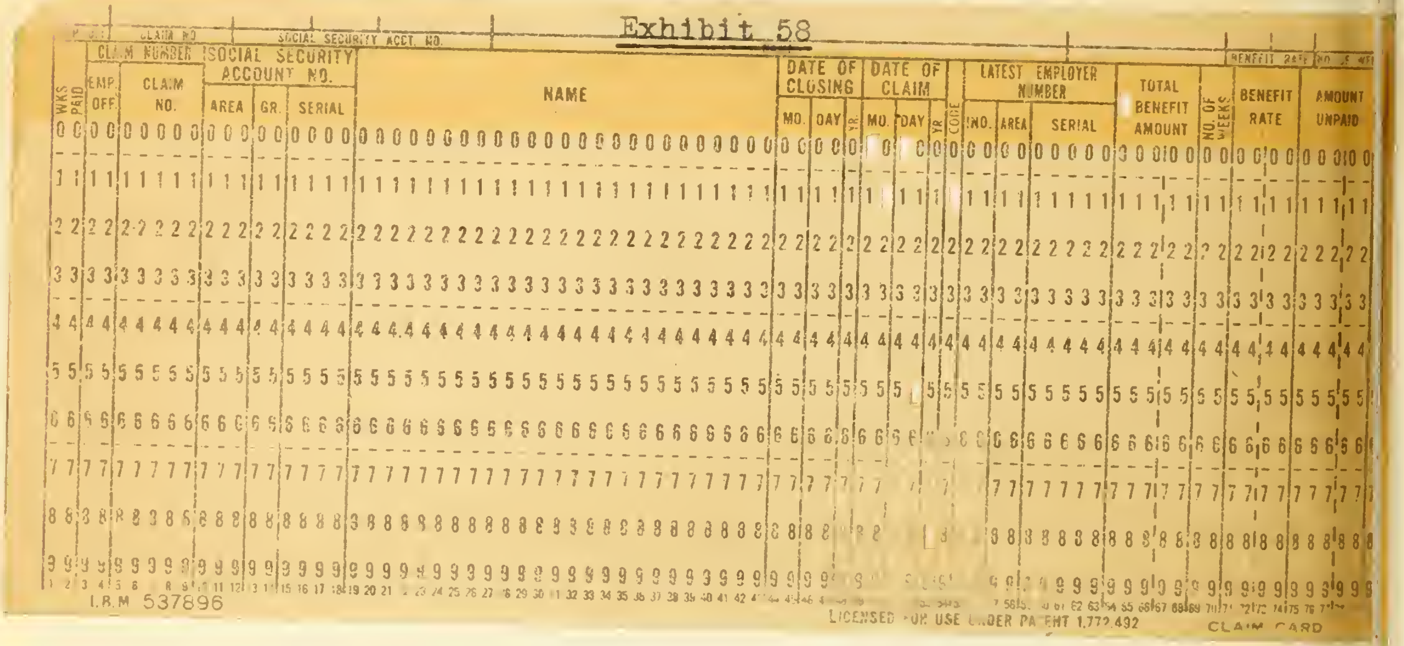
I.B.M. 536702

MASSACHUSETTS UNEMPLOYMENT COMPENSATION COMMISSION

LICENSED FOR USE UNDER PATENT 1,772,492

EMPLOYEE QUARTERLY WAGE CARD

Exhibit 58



CLAIM NO. | SOCIAL SECURITY ACCT. NO.

WKS PAID

CLAIM NUMBER: EMP. OFF. CLAIM NO.

SOCIAL SECURITY ACCOUNT NO.: AREA GR. SERIAL

NAME

DATE OF CLOSING: MO. DAY

DATE OF CLAIM: MO. DAY YR.

CODE

LATEST EMPLOYER NUMBER: IND. AREA SERIAL

TOTAL BENEFIT AMOUNT

NO. OF WEEKS

BENEFIT RATE

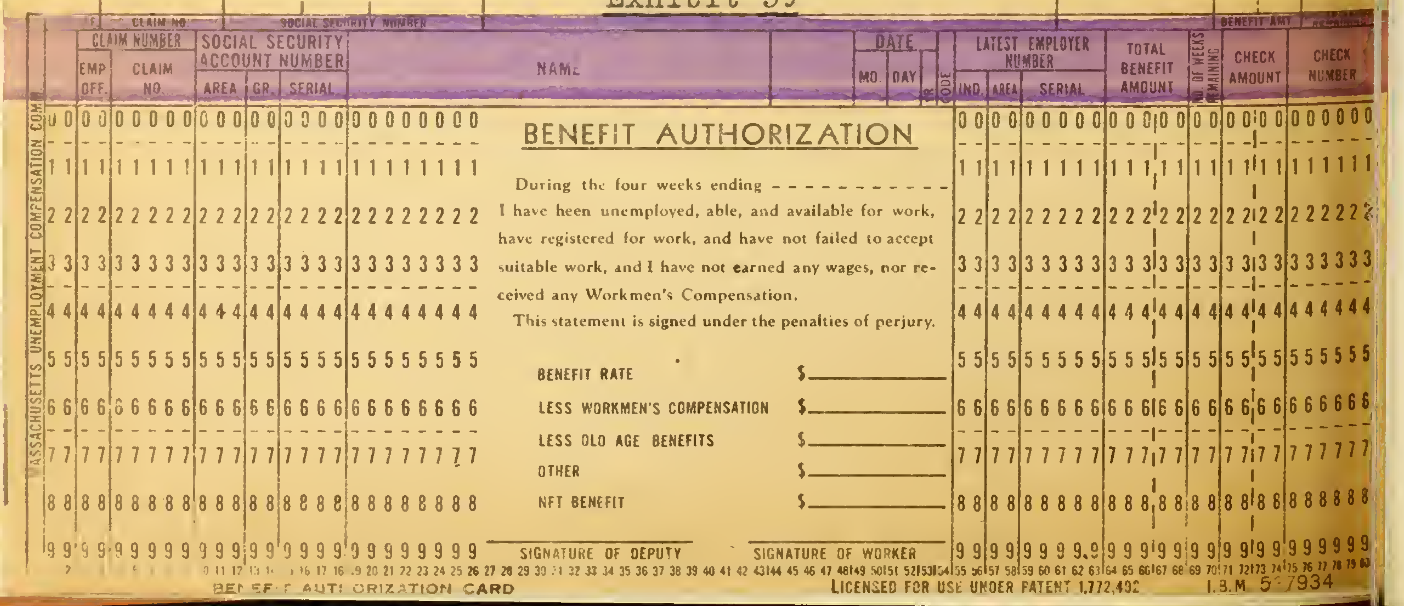
AMOUNT UNPAID

I.B.M. 537896

LICENSED FOR USE UNDER PATENT 1,772,492

CLAIM CARD

Exhibit 59



CLAIM NO. | SOCIAL SECURITY NUMBER | BENEFIT AMT.

CLAIM NUMBER: EMP. OFF. CLAIM NO.

SOCIAL SECURITY ACCOUNT NUMBER: AREA GR. SERIAL

NAME

DATE: MO. DAY

CODE

LATEST EMPLOYER NUMBER: IND. AREA SERIAL

TOTAL BENEFIT AMOUNT

NO. OF WEEKS REMAINING

CHECK AMOUNT

CHECK NUMBER

MASSACHUSETTS UNEMPLOYMENT COMPENSATION COMM.

BENEFIT AUTHORIZATION

During the four weeks ending ----------

I have been unemployed, able, and available for work, have registered for work, and have not failed to accept suitable work, and I have not earned any wages, nor received any Workmen's Compensation.

This statement is signed under the penalties of perjury.

BENEFIT RATE $________

LESS WORKMEN'S COMPENSATION $________

LESS OLD AGE BENEFITS $________

OTHER $________

NET BENEFIT $________

SIGNATURE OF DEPUTY

SIGNATURE OF WORKER

BENEFIT AUTHORIZATION CARD

LICENSED FOR USE UNDER PATENT 1,772,492

I.B.M. 5[illegible]7934

When the employer forms are received by the Unemployment Compensation Commission (U.C.C.), they are grouped in batches of 100 for proving and punching. The computation of tax amount is verified in every instance; in case of variance, the check for the tax is accepted and the employer is billed for the difference by debit or credit memo. The basis of control over the entire tabulating procedure of the U.C.C. consists of adopting refinement of methods only in accounting for the exceptions; accurate control over the large proportion of routine transactions is established in a carefully devised general plan which functions automatically by process of elimination. One employer's card, Exhibit 54, is punched for each monthly contribution. The card form is punched for employer serial number, area and industry code, date received, employee wages subject to tax, number of employees, remuneration other than cash at its fair value, total compensation, employer tax, employee tax, interest charge for delinquency at $5 a day, total amount received, and accounts receivable debit or credit.

The punched cards in each batch are proven in a numeric tabulator against predetermined controls established by calculator footings from the individual forms. The proven contribution card of each employer is posted monthly on a cumulative basis to the employer tabulating card ledger, Exhibit 55. This posting is performed in a bill feed tabulator, and the printed figures for cumulative contributions to date register on a predetermined line. Each employer's ledger card is identified at the top of the card by name, address, and

employer number. The employer ledger card may be printed on both sides and has 12 lines of horizontal registration, or sufficient capacity for a year's posting in the representative case.

The employer's detail card for the current month is grouped with a balance forward summary card when posting cumulative figures to the employer ledger, and a balance forward summary card through the end of the current month is obtained. Thus an employer's ledger card always shows the total amount contributed to date at the end of any monthly period, which avoids the necessity of footing postings if the contributions were entered on a current basis. The current card is separated from the summary cards of the previous period to prepare the cash receipts journal. The employer ledger cards are sorted by employer number with the new balance forward cards, and are refiled in proper numerical sequence in the employer ledger by use of the collator. The summary cards of the prior period are filed in a summary card transfer section.

The 30,000 employers are divided into 15 ledgers for subdivisibility of control. A cash receipts journal is prepared for each of the 15 ledgers every 10 days. The cards punched from individual batches are grouped and sorted by ledger, by sequence of employer number. The cards are listed and cross referenced by batch number. The total cash posted to the journals must agree with the predetermined control established by footing the individual batches. It should be noted that this balance is established on the exception basis,

because in case of variation it is always easy to resort cards back to batch identity and locate any group which fails to agree with control. The detail cards prior to filing are reproduced into another set of detail cards to be used for statistics as experience is gained.

27.4 Maintenance of the Employee Earnings Ledger

All employers who are eligible for Social Security payments are given one of three choices in the method of reporting earnings of individual employees quarterly. If the employer uses tabulating machines, usually the quarterly earnings of each individual are furnished by punching the proper amount into the prepunched and interpreted quarterly wage cards which are provided by the State. The quarterly wage cards are prepunched and interpreted by employer number, employee Social Security number, and employee name, in accordance with the card fields noted in Exhibit 57. It is important to indicate that both the Social Security Board and the Unemployment Compensation Commission arrange their tabulating card files of employee earnings by employee registration number. In fact, the Social Security Board furnished the Commission with a reproduced employee master card, Exhibit 56, in early 1937, for use purely to check the Social Security number initially reported by employers with the registration number standing for the account of the employee in the files of the Social Security Board. Accordingly, an employer who does not use tabulating machines has an option of reporting quarterly earnings of employees on any form which he desires

so long as the sequence of listing is arranged in perfect order of registration number. A third choice of reporting is provided for employers who desire to type the earnings on tabulated lists provided by the State, in which the order of names follows the exact preferred order previously established by the employer; usually this order coincides with the arrangement of employees on the employer's payroll sheets.

In any event, the cards or lists received by the U.C.C. are grouped into batches representing 650 employees and the employee quarterly wage card is completely punched. A batch may include all employees of several different employers, or might represent a small fraction of the employees of one employer. The efficiency of punch operators varies from the completion of 4 to 6 batches a day. About 1,800,000 employees will be reported in each quarter, beginning January 1, 1939.

The cards of employers reporting individual earnings on a punched card basis are manually punched only for quarter, batch number (ganged), status, serial number, and quarterly wages as necessary. When employers report on lists, the original sequence of names is preserved in handling, and the entire card must be punched manually. The individual groups of 650 cards seldom balance after the initial punching operation, but location of errors is obtained on the exception basis. The employee cards of individual employers are pulled and a register is prepared. The register provides a listed record of all information punched in the card and

shows the following data: employee name, date of status, registration number, batch number, employer number, registration number, quarter, wages, and items $400 or over. Summary cards are prepared when listing the register. Tabulation of the summary cards for "0" balance on registration number, wage, and employer number fields, establishes that the original cards were punched in the right columns. The register, in those cases where employers report from lists supplied by the state, provides a torn stub portion which is sent to these employers as the reporting medium of the next period.

The cards of each employer are now proven by checking the wage amount shown on the register with the control total submitted by the employer. If errors originated in the U.C.C. office because of incorrect punching they are located and corrected. If made by the employer, a check is made against the payroll amount shown in the employer ledger, to determine any amount of total variance. The employer must account for difference, both individually and in total.

An important step in the proving operation in 1937 was the verification by the Commission of the employee registration number reported by the employer with the corresponding number reported by the Social Security Board. In event of difference in numbers the employer is notified and adjustment is made as necessary.

The proven employee quarterly wage cards are sorted by registration number and are filed into the employees' wage

ledger by use of the collator. The employee wage ledger is an accumulation of the quarterly earnings cards, so no summary cards are punched to accumulate period figures. The ledger is referred to for earnings history only as benefits are claimed, a further example of regulating work on the exception basis. Over 7,000,000 earnings cards are filed in the employee's ledger annually, a formidable volume. Posting of ledgers for this work would cost $200,000 a year, but governing the operation on an exception basis reduces the cost to about $20,000 a year.[95] The employee ledger is divided into 24 areas in Massachusetts, and over 90 percent of all earnings cards are filed into these area groups. The balance of the cards is filed by other States by areas. The area classification is obtained by sorting the cards on the first three digits of the Social Security Number.

27.5 Benefit Claims and Authorizations

The maximum benefits allowed for accepted claims at present are figured at a rate of 12½ percent for claims made within the first eight quarters. The rate is increased to 15½ percent if the claimant becomes unemployed in the 9th to 16th quarters, but worked continuously in the first 8 quarters. Similarly the rate for the 17th to 24th quarters is 17½ percent for employees who worked steadily in the first 16 quarters. The wage time is figured from the retroactive date of January 1, 1937. The law will probably be changed as the time period lengthens, and a flexible basis will be needed

95 Comment of V. Learson, I.B.M. Salesman

BENEFIT AUTHORIZATION CARD

for establishing employees' cumulative earnings. When such a change takes effect, a tabulating card ledger will be adopted for employees and posting will be accomplished by use of summary cards.

To secure benefits, applicants must file claims personally in local benefit offices. Ineligible claims are rejected on the spot. The claim forms of tentative eligible persons are sent to the Commission. The individual wage cards of each claimant are pulled and the amount of benefit is computed, based on length of time. The claim card, Exhibit 58, is punched in the main office to record the transaction, and the computation is sent to one of the employment branch offices. The duration and amount is based on the highest quarterly wages earned. The amount payable to the claimant is divided by the benefit rate to determine the duration.

In the local office, the claimant accepts the benefit by signing an authorization card for the amount of the benefit and the card is approved by the signature of the local deputy. The claimant must fulfill a three weeks waiting period and must register for employment to signify his availability for work.

Accounting for benefits paid is accomplished by use of the benefit authorization card, Exhibit 59. Benefits are begun by mailing checks to approved claimants three weeks after the authorization is obtained from the local office. The payments are continued weekly throughout the duration period provided that an employee remains unemployed and fails

to earn more than $3.00 per week while out of steady work. A prepunched and interpreted card is sent to the local office to regulate continuance of payments. The worker must appear personally in the local office once a week and sign the authorization tabulating card to specify that he is still out of work and that benefits should be continued; the card is approved by the signature of the local deputy. The control for payment of benefits, and to whom they should be paid, rests in the branch offices. The actual disbursement of cash is controlled by the main office of the Commission. In the week ended February 12, 1938, benefit checks were mailed to 92,000 persons.[96] With respect to size of application the Unemployment Compensation Commission has the largest installation of International tabulating machines in Massachusetts.

28.0 Tabulating Machines in the Banking Field

28.1 The Limited Need for Punched Cards by Banks

The banking business is unique in representing the only major field of economic activity in which punched cards are not generally applied to accounting routine. In the first place, basic banking transactions are fundamentally grouped into a few different types in comparison with the complex problems of general business. There is no vital need for elaborate classifications of accounting data. The most important accounting record in banking activity is the customer's ledger card, and the summary bank balance is the determining unit of banking operation, rather than exhaustive treatment of the individual transactions of which the balance is composed.

96 Authority of V. M. Learson, I.B.M. Salesman

To be sure, large banks have analysis departments for dealing with the larger accounts, but the statistical requirement is more of a special than a routine nature. Much of the success of punched cards in general is due to their replacement of original records for extensive purposes of system building, summarization, classification, and analysis. In banks, the many types of negotiable instruments must be transferred physically from one function to another and must eventually be returned in cancelled form to the maker through the daily reconciliation of account balances. Much of the accounting of individual banks is performed through the functioning of clearing houses. Inasmuch as punched cards cannot replace the negotiable instruments themselves, creation of tabulating cards as a posting medium would be a costly duplication, since the bank paper must circulate from one department to another in any event.

In the past few years tabulating cards have been successfully used for trust accounting by investment banks. In this branch of banking, the problem is complex because of the multiplicity of security issues handled. Punched cards are used for recording buying and selling orders for customer accounts, and perform a real service, through the use of pre-punched files of securities held, in the frequent preparation of customer statements. The machines are also used for statistical purposes.

28.2 <u>The International Bank Proof Machine</u>[97]

The International Company introduced an ingenious

97 Source: Descriptive I.B.M. Folder

device for automatic sorting and clearing of checks a few years ago called the bank proof machine. This device is now used by most large banks because of its labor saving, flexibility, and accuracy. The machine consists of a control adding mechanism operated by ten keys which both lists and accumulates check totals on a master control tape and provides for automatic sorting of checks to twenty-four sorting compartments which are also equipped with adding mechanisms. In other words, depression of the keys of one master adding machine lists and accumulates a grand total of all checks deposited and controls the sorting, listing and counting of checks received in twenty-four individual receptacles. Every deposit is separately proved, since items listed on the control tape are a complete record of all checks passing through the machine. The checks are listed in the same sequence as received from depositors, with symbols identifying the banks on which checks are drawn. Both the adding machine classification and check amount are visible on a special indicator before the release bar is depressed. Lights signal when sorting receptacles become full and when paper supply is almost depleted. The machine may be used as an ordinary adding machine without the twenty-four separate adding devices. The checks are automatically counted as they are sorted. A counter indicates the total number of checks sorted in each block and a separate counter shows the grand total of checks sorted and listed for all blocks.

In a single operation the bank proof machine accomplishes what formerly required three steps. It sorts and lists checks according to banks, provides totals, and proves all checks against deposit slips. The machine is leased to banks on a rental basis, similar to the plan of marketing tabulating machines.

29.0 Conclusion

29.1 Constructive Inferences of the Cases Studied

The fundamental purpose of this thesis has been to trace the origin, growth, and breadth of tabulating machine application to the accounting system, and statistical problems of business. The many cases described were carefully chosen from the entire range of business activity. In every instance a different type of machine application has been presented to illustrate tabulating machine utility. The discussion of available types of tabulating equipment and machine specifications has indicated that a wide range of devices exists, from which individual units are chosen to suit the problems of customers. Tabulating machine salesmen are especially well trained systems engineers, not order takers. Most of the salesmen have been trained in factory schools and serve a junior apprenticeship in sales offices to determine their eligibility for personal calling upon customers, as company sales representatives. Many tabulating machine salesmen are accountants in their own right.

When tabulating machine salesmen and customers confer to build a punched card system, the course of procedure

is to determine from the wide range of machine utility those flexible features which must be provided for the specific job to be done. The actual machine units selected are chosen with reference to the individual problem, and it is important to note that regardless of the identity of the units selected, the group of machines determined and the method applied represents in the typical case the best known method of doing the work. In the Burbank Company, the extension of cost of sales by multiplier represents the most outstanding advantage from use of punched cards. Tabulating machines are used by the Halliday Company for accounts receivable to derive advantages from the speedy performance of all machines and the particular benefit of the automatically aged trial balance. In the F. H. Browning punched cards are used for payroll accounting and shop order control both because the cards are so valuable as sources of original information which may be woven automatically into an accounting system, and because the multiplying punch in particular provides excellent facilities for extending the payroll, computing the tax deductions, cross footing the net earnings, and applying the overhead absorbed. Tabulating machines are required by chain stores because of the extreme volume of transactions, the balancing of most vital control functions, and the advantageous use of prepunched, denominated inventory cards which are made possible by standardization of packing units. The Eastern Gas and Fuel Company makes use of tabulating cards for accounts payable and general ledger accounting

because of the complexity involved in paying bills for subsidiary companies, because of the speedy closing of entries permitted, and because tabulating card drafts are automatically prepared by the check writing interpreter. The Merrill Company utilizes punched cards for finished stock inventory control on account of the benefits obtained from centralized administration and the use of the comparing reproducer. The Boston and Maine Railroad applies punched cars to car accounting in view of the large volume of transactions, the need for accurate information provided speedily, and the important requirement for operating statistics. The Interstate Life Insurance Company employs tabulating machines as the indispensable means of controlling tremendous transaction volume and innumerable distributions caused by especial complexity of the insurance business. Policy activities are subject to such frequent change that maximum flexibity must be obtained from comparing reproducers, interpreters, and tabulators.

In short, most large businesses possess sufficient volume of transactions and intricacy of accounting control to warrant the use of punched cards. The individual punched card possesses the initial advantage of consolidating in one recording medium all of the fundamental factors of the problem in question by transfer of data from original records through the punching of holes. The accuracy and permanence of the proven punched card records aims for dependable and quickly obtained results when reports are tabulated in machines.

The superiority of a tabulating machine system over manual methods is evident in most stages of work following the punch- and proving of fundamental card forms. Almost all subsequent operations, whether the sorting process, extension by the multiplier, duplication by the reproducer, listing or tabulating of reports by the accounting machine, or balance forwarding by summary card punch are performed much more quickly, much more accurately, and with much less effort than by manual plans.

Many of the chief advantages of the tabulating method are measured by such intangible features as flexibility, speed, accuracy, elimination of peak loads, intensiveness, and efficiency. The chief advantage of all, however, aside from better performance, is the saving in cost under the tabulating method. The size and complexity of the particular accounting problem determines how great an economy, if any, may be obtained by substituting a punched card plan for manual procedure. A preliminary survey of a problem determines whether or not the work can be done at reduced cost under the tabulating plan. The fundamental problem must be sufficiently great so that the cost of machine rentals for installed equipment may be absorbed. The saving in cost is one of degree. Insurance companies utilize tabulating machines extensively, yet the cost of the punched card plan is many times more economical than the cost of a manual method for doing the same work. Barring the cases of large machine installations for handling the tremendous problems, in which enormous saving in cost is realized, most

tabulating systems result in a substantial cost reduction. One of the chief elements of tabulating cost is the direct cost of producing proven tabulating cards, of which the main factor is labor. If the problem is sufficiently complex to absorb the cost of preparing cards, all other tabulating machines generally pay for themselves with marked attendant saving. In the normal case, tabulating systems require fewer clerks than manual plans and result in substantial reduction in payroll cost. It is generally advisable to install tabulating machines whenever the comparative costs of machine and manual methods for a particular job are about the same, for the proving of punched card equipment for one kind of work invites expansion of the original undertaking by transfer of other work to machines, thus causing the saving in expense to become really apparent. For those companies whose accounting problems are too limited to afford the expense of installed equipment, tabulating machine facilities are provided on a service basis; customers usually lease punches in such cases for use on their premises and send the punched and proven cards to service bureaus for sorting, tabulating, and other machine work.

The use of tabulating machines for banking illustrates one of the limitations of the punched card plan. Work must not only be voluminous, embodying the problem of size, but the data must be subject to numerous classifications and the requisite for extensive analysis of detail. Banking routine does not generally fall in this class, as few distribu-

tions are necessary in accounting for total deposits and withdrawals. Department store sales audit is another type of application which is not adapted to the tabulating machine method, as the analysis does not go beyond the classification of sales and returns by department and by sales person, cash sales and credits separately.

While the particular illustrations of punched card application described in this thesis are representative of the type of adaption found in practice, they serve, in total, barely to sample the variety of uses for which tabulating machines are put. A complete classification of purposes for which machines are engaged would be as elaborate as the specific problems of business. Most governments all over the world make use of tabulating machines for statistical purposes. Machines are used by publishing houses to control the circulation of books. They are employed by textile mills for establishing production costs and measuring output. They are successfully adapted for payroll under the Bedeaux point system of wage incentive plan. They are utilized by the United States Department of Justice to identify millions of criminals by their finger prints. This list of actual uses of punched cards could be expanded over the entire realm of economic activity.

Several important facts must be stated concerning the scope of application. First, many individual users of tabulating machines use one or more sets of tabulating equipment for many different purposes. Second, while statistics

are not available regarding the number of equipment customers and the number of installed machines outstanding, more tabulating machines are used for accounting and statistics today in most countries of the world than ever before. The size of installations has increased greatly in the past seven years because of the many new and improved devices which have been made available. Third, the invention of new machines will create new uses for machines in the future. The machine accomplishments which are actual today would have been considered impossible ten years ago. Fourth, the trend of punched card activity is for continued growth.

29.2 The Financial Success of the International Business Machines Company.

A most revealing indication of the universal spread of punched card development may be gained from considering the financial history of the International Company. The total assets of the company today are estimated to be over $65,000,000, or more than three times as great as in 1912, the first year of operation under the merger.[98] Net profit before depreciation, obsolescence and research cost for 1937 will be about $14,500,000. Net earnings before Federal taxes will exceed $10,000,000. The cash dividends paid to over 700,000 shareholders will exceed $4,600,000. The unappropriated surplus for 1937 will approach $2,500,000.00. The previous estimates are based on 1936 actual figures and follow the trend of prior years.

98 Financial references from "Moody's" Industrials.

The net profit after depreciation and Federal taxes has grown from $540,000 in 1912 to nearly $9,000,000 in 1936. The Company has never had an operating deficit, has never passed a dividend, has always paid current dividends out of current earnings, has never needed to use earned surplus to pay dividends, and has always had a substantial balance of undistributed profits to add to earned surplus each year. The prior statement is based on actual examination of all income statements from 1912 through 1936 and reveals a remarkable record of continued prosperity. The Company has no funded debt. Its stock is one of the most stable listed and is usually found in the portfolios of "blue chips" recommended highly by investment banks. During the depression year of 1932, the financial success of the International Company was not impeded. Each of the last five years has produced more sales revenue and larger net profit than the one preceding it. Because of the impetus of Social Security installations, as well as general growth in other directions 1937 was the most successful year in the history of the Company.

The International Company establishes a reasonable annual sales quota base for each of its salesmen and branch offices all over the world. In case the performance of branch offices as a unit and the records of individual salesmen exceed quotas, respectively, by the end of the year, those who qualify are invited to New York as guests of the Company for initiation into "The 100 Per Cent Club". In order to exemplify the great success of the selling year 1937, and to

substantiate prior statements regarding the steady growth of punched card development, 238 salesmen in the United States were initiated into the 1937 Club.[99] The highest ranking salesman achieved 731 percent of quota; the second, 552 percent; and the third 479 percent.[100] While this splendid record of 238 Club members constitutes the largest number of domestic representatives ever elected in the history of the Company, it will be broken in some subsequent year, just as other Company records were shattered by the accomplishments of 1937. It should be mentioned that a large number of foreign salesmen are also elected to Club each year. Most significant of all, there are numerous branch managers and salesmen who have made the Club on several occasions, and a select few who have never missed the honor.

29.3 Do Tabulating Machines Create Technological Unemployment?

It usually results that the adoption of tabulating systems causes a reduction in personnel when displacing manual methods. This does not mean that large numbers of people lose employment because of the use of punched cards. It must be appreciated that the tabulating machine producers provide employment directly for over 14,000 company employees, and indirectly for many employees of other concerns which supply the manufacturers with materials. Far more important than the personnel of the makers is the vast number of employees all over the world who operate installed equipment. Tabulating machines are efficient tools of management, and their use provides timely, accurate, and complete information upon which

99, 100 Statement of E. Betz, I.B.M. salesman

executives may judge more accurately. Because of the determination of important facts at regular scheduled intervals, management exercises more direct action and efficiency is enhanced. Wastes are eliminated, costs are lowered, funds are spent more wisely. The availability of vital business data has an indirect effect, however slight, in improving the progressiveness of a business, which is apt to be reflected in larger profits or smaller losses. When tabulating method displaces manual method, usually the efficient personnel is retained in the tabulating department to operate the new system. Often the remainder of the clerks not required are transferred to other work, and only the least efficient people are released. This is as it should be, for efficient methods must supersede inadequate routines, if a business is to be controlled most advantageously. Ordinarily employment in operation of tabulating machines is steady work, for the tabulating department usually has ample volume of work because of its accounting nature even though producing departments may be slack. Clerks who become skilled in operation of tabulating machines acquire skill and technical knowledge, which is often apt to result in tabulating employment during their entire business careers. Instead of creating unemployment through replacement of human labor by automatic machinery, therefore, use of punched cards serves to stabilize employment for all individuals directly or indirectly associated with the tabulating machine industry.

29.4 The Future of Punched Card Accounting

Past performance is the usual barometer for anticipating the future, but forecasts must always be made qualitatively. Sooner or later in all business activity expansion ceases and retrogression begins. The tabulating machine business, judging from past records, will continue to grow for many years, perhaps decades, to come. New devices are still to be invented or perfected. New uses are yet to be discovered. The business of today has no appreciable weaknesses. Its success appears to be immune from depression shocks because in bad times when expenses must be curtailed, punched cards are a leading means of saving money. The tabulating machine industry is affected directly by the stage of the cycle of general business, but in the past new business has always greatly exceeded cancellations. One of the main reasons for the predominant success of punched card accounting is the permanence of customer clientele. Because of the marketing of equipment by lease agreement, revenue is stable with an upward trend, with little sales effort necessary to retain satisfied customers permanently. Once convinced of the advantages of punched cards by actual use from installation, most customers recognize the superiority of punched cards, not only adhering to, and improving, original plans for which machines were ordered, but adapting new uses to the equipment. Notwithstanding the marked expansion of applications among present customers of long standing, the chief source of totally new business for 1937 originated from entirely new users of tabulating equipment who had never employed

punched cards before.

The future outlook for the tabulating machine industry is brilliant, far more attractive than most of our exceptional American companies. Since the products of the industry are highly specialized, and since their use is diffused throughout the world, the demand for machines will continue so long as large scale business flourishes. The rental basis of sales revenue guarantees constant income. In most industries competition usually results in overproduction and depresses the market for all producers. The two manufacturers of tabulating equipment have no competition in the consequential tabulating systems. Not only would a new manufacturer be confronted with huge capital investment and be severely handicapped by lack of manufacturing freedom because of patent infringement, but also the inferior products of the new company would probably be obsolete when placed in the market, because of the intervening changes made by the existing industry. Because the inherent nature of the business is monopolistic, manufacturers may control obsolescence of equipment and regulate the substitution of new improved models for inferior devices. The distribution of machines in large, comparatively undeveloped foreign markets is another reason for suspecting that the future for punched cards will be bright. The most striking cause for the remarkable achievement already made is the widened differential between the merits of punched card equipment and manual processes which have been made possible by each new device introduced. The multiplier, the summary punch, the reproducer, the check writ-

ing interpreter, the alphabetic machines, and the collator, - all have added materially to the advantage existing when they were invented. The new devices of the future will solidify use of punched cards even further.

Thomas J. Watson, President of the International Business Machines Corporation, has stated recently that there is not one machine out of a line of 600 whose potential market is even approaching saturation. He believes that about 5 per cent of the world market for punched cards is being serviced today. The Company's market is growing in three ways:[101]

(a) The formation of new business, and the growth and merging of existing businesses all over the world are creating new situations requiring the facilities of the Company.

(b) New fields of application are constantly developing new uses for present machines, new and better ways of applying them to some specific task, which open wholly new fields of opportunity which previously were not known or considered out of reach.

(c) Needs for speedy, economical, and accurate organization of business facts along different lines from those previously experienced are constantly being discovered. Often, highly specialized requirements of great proportion, common to whole industries are discovered, and a completely new machine, or an attachment to, or modification in, some existing machine is devised to solve the problem.

Mr. Watson has often said: "I B M is not merely an organization of men; it is an institution which will go on forever."

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APPENDIX

Exhibit Number	Description
1	Burbank Co. - Cumulative Trial Balance
2	Burbank Co. - Cumulative Accounting Report
3	Burbank Co. - Cumulative Comparative Sales Report
4	Burbank Co. - Government Class Sales Tabulation
5	Burbank Co. - Analysis of Sales by Fabric Division
6	Burbank Co. - Sales by Customers by Classes of Goods
7	Halliday Co. - Daily Sales Register
8	Halliday Co. - Cash Sheet
9	Halliday Co. - Trial Balance
10	Halliday Co. - History
11	Halliday Co. - Statements
12	F. H. Browning Co. - Weekly Payroll Sheet
13	Interstate Life Insurance Co. -Ordinary Code Sheet
14	International Mechanical Key Punch
15	International Mechanical Verifier
16	International Electric Key Punch
17	International Duplicating Punch
18	International Motor Drive Key Punch
19	International Motor Drive Verifier
20	International Motor Drive Duplicating Punch
21	International Alphabetic Duplicating Punch
22	International Alphabetic Duplicating Printing Punch
23	International Automatic Numbering Gang Punch
24	International Automatic Reproducing Punch
25	International Automatic Multiplying Punch
26	International Automatic Check Writing Interpreter
27	International Alphabetic Interpreter
28	International Counting Sorter
29	International Type 92-Five Counter Tabulator
30	International Type 285 Electric Accounting Machine
31	International Type 375 Invoicing Tabulator
32	International Direct Subtraction Accounting Machine
33	International Type 405 Alphabetic Accounting Machine
34	International Automatic Summary Punch
35	International Duplicating Summary Punch
36	International Gang Summary Punch
37	International Continuous Form Feed
38	International Automatic Carriage
39	Wiring Diagram for Numeric Automatic Plugboard
40	Wiring Diagram for Reproducing Punch
41	International Rental Agreement
42	International Bank Proof Machine
43	Powers 45-Column Key Punch
44	Powers 45-Column Automatic Key Punch
45	Powers 90-Column Automatic Key Punch
46	Powers Reproducing Punch
47	Powers Multiplying Punch

48 Powers Standard Sorter
49 Power 90 column Sorter
50 Powers Counting Sorter
51 Powers 45 column Numeric Tabulator
52 Powers 90 column Numeric Tabulator
53 Powers Summary Card Punch

Report #1

The Lumberman's Exchange

Cumulative Trial Balance - Jan. 31 1938

JAN 31 1938

701 11	263cr	5000cr	263cr
701 23	52cr	833cr	52cr
701 24	1373cr	14164cr	1373cr
701 41	239cr	2499cr	239cr
701 73	2975cr	11664cr	2975cr
701 83	119cr	2500cr	119cr
701 84	379cr	9167cr	379cr
Total Credits	5400cr	45827cr	5400cr
701 11	6701	180000	
701 23	22341	373323	
701 24	91334	1041654	
701 34	129462	3690000	
701 41	86784	566657	
701 43	3938	36664	
701 51	11030	72500	
701 53	5425	55000	
701 65	24574	840000	
701 69	4804	230000	
701 73	147411	810830	
701 83	14040	344166	
701 84	67253	1039984	
701 91	18654	219997	
701 93	113	3332	
701 95	42299	563332	
Total Debits	676163	10667459	
Net Total	670763	10621612	5400cr

115cm
51cm
719cm
116cm
1781cm
65cm
196cm

5024cm

3695
15158
53447
78025
48609
2391
6291
3161
14100
2951
90206
9135
38867
10755
136
23560

399587

390563

Sheet 2

Cumulative Net Shipments Inquiry — [illegible]

Mr Gray

SAN FRANCISCO JAN 31 1938

Salesman	Farm. Class	Net Shipments in Dollars	Net Shipments in Bagging	Cash Shipments in Dollars	Net to
701	11	$ 6430	175000	$ 263.00	$
701	22	22289	372490	52.00	4
701	24	89961	1027490	1575.00	6
701	34	129462	3690000		3
701	41	86545	564158	239.00	
701	42	5938	56664		
701	51	11030	72500		
701	52	5425	55000		
701	65	24574	840000		4
701	69	4804	250000		1
701	72	144436	799166	297.50	6
701	82	15921	341666	119.00	4
701	84	66874	1630817	379.00	0
701	91	18654	219997		3
701	92	112	5532		
701	95	42299	565532		2
		$ 670762	10621612	$ 5400.00	$ 1

Report #1

The Lumbrook Co.

Cumulative Trial Balance - [illegible]

JAN 31 1938

701 11	203cr	5000cr	263cr	115cr
701 23	52cr	833cr	52cr	31cr
701 24	1373cr	14164cr	1373cr	719cr
701 41	239cr	2499cr	239cr	115cr
701 73	2975cr	11664cr	2975cr	1781cr
701 83	119cr	2500cr	119cr	65cr
701 84	379cr	9167cr	379cr	195cr
Total Credits	5400cr	45827cr	5400cr	3024cr
701 11	6701	180000		3695
701 23	22341	375323		15158
701 24	91334	1041654		53447
701 34	129462	3690000		78025
701 41	86784	506657		48609
701 43	3938	36664		2391
701 51	11030	72500		6291
701 53	5425	55000		3161
701 65	24574	840000		14100
701 69	4804	350000		2951
701 73	147411	810830		90266
701 83	14040	344168		9135
701 84	67253	1639984		38867
701 91	18654	219997		10735
701 93	113	3332		136
701 95	42299	563332		23560
Total Debits	676163	10667439		399587
Net Totals	670763	10621612	5400cr	396563

Sheet #2

Cumulative Net Shipments Analysis — [illegible] Company

Mr. Gray

SAN FRANCISCO JAN 31 1938

Salesman	Garm. Class	Net Shipments in Dollars	Net Shipments in Dozens	Credit Shipments in Dollars	Net This Week
701	11	$ 6438	175000	$ 265cr	5580
701	22	22289	372490	52cr	15127
701	24	89961	1027490	1575cr	55728
701	34	129462	3690000		73025
701	41	86545	564158	259cr	48553
701	42	5938	36664		2591
701	51	11030	72500		6291
701	52	5425	55000		5161
701	65	24574	840000		14100
701	69	4804	230000		2951
701	72	144436	799166	2975cr	83485
701	82	13921	341666	119cr	9069
701	84	66874	1630817	379cr	38671
701	91	18654	219997		10755
701	92	112	3332		136
701	95	42299	363332		22560
		$ 670762	10621612	$ 5400cr	$ 390363

Report #3

Comparative Net Shipments Analysis – The [illegible] Company

Mr. Gray

SAN FRANCISCO JAN 31 1938

Schedule Class	Harm.	Net Shipments in Dollars 1938		1937	Net Shipments in Doz. 1938	1937
701 11		$ 64	+		17	
701 22		222	–	$ 320	37	47
701 24		899	–	1616	102	202
701 34		1294	+	918	369	230
701 41		865	–	1789	56	128
701 42		39	–	49	3	4
701 51		110	–	280	7	20
701 52		54	+	19	5	1
701 65		245	+	132	84	45
701 69		48	+	24	23	14
701 72		1444	–	1975	79	102
701 82		139	–	207	34	46
701 84		668	+	447	163	105
701 91		186	–	285	21	38
701 92		1	–	3		
701 95		422	+	208	56	25
		$ 6707	–	$ 8278	1062	1014

Report #4

The Burbank Company

For the [illegible] of [illegible]

JAN 31 1939

Firm Code Being Based Class Office	Net Sales [illegible] Revenue by Billing Office	[illegible] Drawn by Billing Office	[illegible]	[illegible]
11 1 1	65000		4145	
11 1 2	60000		3453	
		125000		7598
11 2 1	225000		7958	
11 2 2	25000		875	
		250000		8833
11 3 1	294168		10916	
11 3 2	290000		9606	
		584168		20522
24 1 1	875835		100871	
24 1 2	855830		101817	
		1731665		202688
24 2 1	1791678		97914	
24 2 2	2604991		141511	
		4396669		239425
24 8 1	135004		11463	
24 8 2	74168		9154	
		209172		20617
34 7 1	25695845		1103044	
34 7 2	22702500		990604	
		48398345		2093648
41 1 1	1602514		241828	
41 1 2	1786661		247250	
		3389175		489078
41 2 1	2459177		184002	
41 2 2	4784996		352649	
		7244173		536651
51 1 1	2675852		494449	
51 1 2	260000		58440	
		2935852		552889
51 2 1	5125844		554432	
51 2 2	697500		62859	
		5823344		617291
51 3 1	1140834		57137	
51 3 2	145000		6090	
		1285834		63227
51 8 1	131667		11901	
51 8 2	10000		900	
		141667		12801
65 7 1	8502500		250693	
65 7 2	7390000		214546	
		15892500		465239
69 7 1	5390834		89469	
69 7 2	2062500		43269	
		5453334		132738
84 5 1	3403341		174177	
84 5 2	3135825		145751	
		6539166		319928
84 6 1	2641667		94748	
84 6 2	3018326		112363	
		5659993		207111

Report #5

The Dunbar Company

Monthly Net Shipments Delivered by Net Class

JAN 31 1938

Farm Class	Net Class	Net Shipments	Net Tons	Freight Rate	Net Freight
11	03	# 20522	584168	45832cm	# 12343
11	04	8833	250000	5000cm	6130
11	05	7598	125000	10000cm	4533
		36953	959168	60832cm	23056
23	12	87028	1751665	12499cm	50544
23	13	481259	10075558	126655cm	357982
23	14	59582	409167	4166cm	33763
23	16			2500cm	
		628469	12234170	145820cm	457287
24	23	70159	1404166	15833cm	55905
24	24	151595	1540833	84997cm	[illegible]
24	25	25016	464994	10000cm	15866
24	26	197343	2710341	246655cm	113259
24	27	14180	146670	70833cm	13714
24	28	6437	62502	29999cm	[illegible]
		462750	6337500	458317cm	271695

Cleveland Office - Mr. Richardson

Annual Customer Report

Fiscal Year Ending Nov. 30, 1937

Customer	Town	St	GC	1937 Sales by Customer by Gar Class		1937 Sales by Customer		1937 Cost of Sales by Class
E.J. Beardsley Co.Inc.	Batavia, New York				*	2524		
0021	148	17	9	350				176
Scott & Bean Inc.					DC *	350		
0024	148	17	4	20425				12350
0024	148	17	2	5874				3700
0024	148	17	7	5825 X				3576
0024	148	17	9	550CR				334CR
J.N.Adam Co.Inc. Buffalo					P *	31574		
0047	312	17	5	459623				293055
0047	312	17	8	2450				1747
0047	312	17	3	16174				10254
0047	312	17	6	3800				2303
0047	312	17	0	34125				26951
Adam Meldrum & Anderson Co.Inc.					P *	516172		
0048	312	17	5	292892				177728
0048	312	17	4	170288				101709
0048	312	17	2	19351				9437
0048	312	17	7	80450 X				48669
0048	312	17	1	2500				1564
0048	312	17	9	83382				52144
0048	312	17	8	30174				18943
0048	312	17	3	24443				15985
0048	312	17	6	6725				4179
0048	312	17	0	69863				55843
L.L. Berger Inc.					P *	780068		
0054	312	17	2	8388				5818
0054	312	17	7	235117 X				176967
0054	312	17	1	612				417
0054	312	17	0	23813				29441
David's Spec.Shops Inc.Store #10					P *	267930		
0713	312	17	7	38187 X				23391
E.W.Edwards & Son Inc.						38187		
0068	312	17	4	102516				61031
0068	312	17	2	41645				24676
0068	312	17	7	15000 X				9175
0068	312	17	9	1823				1170
0068	312	17	8	7665				4924
0068	312	17	3	54149				37678
0068	312	17	6	20239				12279
					P *	243037		

Travelers Office - Mr. Gladyshaw

Annual Customer Report

Fiscal Year Ending Nov. 30, 1927

Customer	Code	Sales by Customer	1927 Sales by Customer	1927 Sales by Customer	1927 % of Sales by Class
A.O. Beardsley Co.Inc.					
0021	1H8 17 9	560			176
Scott & Sean Inc.					
0022	1H8 17 8	20425			
0023	1H8 17 5	5214			
0024	1H8 17 7	5895 X			
0025	1H8 17 3	56005			
J.K.Adam Co.Inc. Buffalo					
0047	312 17 5	45425			
0048	312 17 8	2450			
0049	312 17 2	16114			
0050	312 17 8	7500			
0051	312 17 0	34125			
Adam Meldrum & Anderson Co.Inc.					
0053	312 17 5	22526			
0054	312 17 4	17025			
0055	312 17 6	13751			
0056	312 17 7	80470 X			
0057	312 17 1	2500			
0058	312 17 9	5752			
0059	312 17 8	30174			
0060	312 17 3	24443			
0061	312 17 4	0725			
0062	312 17 0	5943			
A.L. Berger Inc.					
0064	312 17 6	8756			
0065	312 17 7	22117 X			
0066	312 17 1	816			
0067	312 17 0	23213			
David's Apparel Shops Inc.Stores Div					
0713	312 17 7	38187 X			
S.T.Edwards & Son Inc.					
0066	312 17 4	10255			
0067	312 17 2	41645			
0068	312 17 1	15000 X			
0069	312 17 5	1825			
0070	312 17 8	1065			
0071	312 17 3	54140			
0072	312 17 6	7025			

REPORT #7

THE HALLIDAY COMPANY

DAILY SALES REGISTER

Div Led	St	Customer	Pro No	Date Mo	Day	Yr.	Accounts Receivable	Freight
13	11	53240	3101	12	21	7	22498	1096
13	11	53240	3102	12	21	7	14895	703
13	15	53280	3157	12	21	7	54709	2384
13	12	53308	3196	12	21	7	6342	158
13	12	53308	3197	12	21	7	7938	216
13	14	53336	3218	12	21	7	2612	137
13	14	53350	3249	12	21	7	8424	425
13	17	53378	3276	12	21	7	7102	321
13	16	53392	3305	12	21	7	12638	842
13	16	53392	3306	12	21	7	30967	1886
13	16	53392	3307	12	21	7	2582	157
13	13	53406	3342	12	21	7	10486	487
13	13	53406	3343	12	21	7	9963	396
13	13	53406	3344	12	21	7	42680	1854
13	13	53406	3345	12	21	7	6486	228
13	13	53406	3346	12	21	7	3219	116
		Total					869825	41652

REPORT BY

THE RAILWAYS COMPANY

D A I L Y R A I L S R E G I S T E R

Div Leg Sh	Customer Pro No	Date Do Day Yr	Description Description
13 11	53400 3103	12 21 7	[illegible]
13 11	53400 7102	12 21 7	[illegible]
13 10	53400 3137	12 21 7	[illegible]
13 12	53300 3135	12 21 7	[illegible]
13 10	53300 3137	12 21 7	[illegible]
13 10	53400 3218	12 21 7	[illegible]
13 14	53450 3140	12 21 7	[illegible]
13 17	53374 3279	12 21 7	[illegible]
13 16	53392 3305	12 21 7	[illegible]
13 16	53392 3300	12 21 7	[illegible]
13 16	53392 3307	12 21 7	[illegible]
13 13	53406 3342	12 21 7	[illegible]
13 15	53406 3343	12 21 7	[illegible]
13 13	53406 3344	12 21 7	[illegible]
13 13	53406 3345	12 21 7	[illegible]
13 13	53406 3346	12 21 7	[illegible]
. . . . .			
	Total		[illegible]

REPORT #8

THE HALLIDAY COMPANY

DAILY CASH RECEIPTS

Division 2 Ledger 2 Dec. 21, 1937

Customer	Bank Number	Net Cash	Discount	Freight	Other Deductions Account	Other Deductions Amount	Accounts Receivable Cr
12475	882052	136929	2351				139280
13148	81651	53447	932		612	246	54625
13292	8841	77511	1333	7500			86344
14251	12	5357	109				5466
14317	1108	14026	248				14274
14426	6142	36180					36180
14453	8845	220742	3842		612	416	225000
14582	6474	38816	792				39608
14780	84137	5426					5426
15402	880522	8981	183				9164
15816	632	66240	1140	4961			72341
16146	352	29170	512				29682
16323	1114	43220	749		612	96	44065
16662	841	30294					30294
17187	6184	28579	583				29162
17742	8621	49433	879		612	128	50440
18312	391	12967					12967
	*	857318	* 13653	12461		886	884318

Summary for Posting

Dr.	Cash	857318	
Dr.	Sales Discount	13653	
Dr.	Freight Allowed	12461	
Dr.	Acct. 612	886	
Cr.	Accounts Receivable		884318

Note: A stubbed flap is used with carbon insert for duplicate impression of columns 1,2, and 3. The detached flap is the bank of deposit slip.

REPORT #9

THE HALLIDAY COMPANY

DIVISION 3 LEDGER 4 TRIAL BALANCE AS OF JUNE 1, 1937

Customer Number	Date Mo	Day	Yr	Tran	Balance	Current	1-30 Days Overdue	31-60 Days Overdue	61-90 Days Overdue & Over
65432	0	00	0	00					
65432	3	23	7	11	23684		23684		
65432	3	23	7	11	6201		6201		
65432	3	23	7	11	1696		1696		
65432	4	12	7	11	2078	2078			
65432	4	14	7	11	2493	2493			
65432	5	27	7	11	533	533			
65432	5	27	7	11	15296	15296			
65432	5	28	7	33	200CR	200CR			
					* 51781	* 20200	* 31581		
65435	0	00	0	00					
65435	2	01	7	12	258			258	
65435	2	18	7	11	3963			3963	
65435	2	18	7	36	642CR			642CR	
65435	3	15	7	11	7659		7659		
65435	4	28	7	11	25312	25312			
65435	5	12	7	14	1254	1254			
65435	5	13	7	37	3000CR			3000CR	
					* 34804	* 26566	* 7659	* 579	
65442	0	00	0	00					
65442	1	17	7	11	2350				2350
65442	1	29	7	11	14036				14036
65442	2	21	7	11	6049			6049	
65442	2	24	7	11	7385			7385	
65442	3	15	7	11	4415		4415		
65442	3	16	7	11	1261		1261		
					* 35496		* 5676	* 13434	* 16386
65447	0	00	0	00					
65447	5	10	7	11	25237	25237			
65447	5	12	7	11	54152	54152			
65447	5	15	7	11	3248	3248			
65447	5	19	7	11	2963	2963			
65447	5	19	7	11	14624	14624			
65447	5	19	7	11	121565	121565			
65547	5	19	7	11	24917	24917			
					* 246706	* 246706			

Note: A four inch margin at the left, not shown in the above form, is reserved for decoding customer identity by typewriter.

REPORT #10

THE HALLIDAY COMPANY

NAME The J.M. Titus Co., Inc.
ADDRESS Roanoke, Virginia

HISTORY

Division 33 Account No. 39642

Customer Number	Date Mo	Day	Yr	Tran	Debit	Credit Mo	Day	Yr	Tran	Detail Cash	of Discount	Remittance Others	Freight
39642	1	15	7	11	25229	2	12	7	31				
39642	1	18	7	11	37546	2	12	7	31				
39642	1	21	7	11	15927	2	12	7	31				
39642	1	21	7	11	32916	2	12	7	31				
39642					400CR	1	22	7	33				
39642	1	24	7	11	28062	2	12	7	31	136929	2351		
39642	1	25	7	11	9000	3	13	7	31				
39642	2	04	7	11	16215	3	13	7	31				
39642	2	18	7	11	25267	3	13	7	31				
39642	2	28	7	11	32526	3	13	7	31	81380	1411	217	
39642					348CR	1	12	7	36				
39642	3	15	7	11	7658	4	11	7	31				
39642	3	15	7	11	21451	4	11	7	31				
39642	3	21	7	11	20682	4	11	7	31				
39642	3	22	7	11	9654	4	11	7	31				
39642	3	22	7	11	13444	4	11	7	31	66440	1140		4961
39642	4	01	7	11	43229	5	12	7	31				
39642	4	03	7	11	21658	5	12	7	31				
39642	4	10	7	11	10918	5	12	7	31				
39642	4	10	7	11	62438	5	12	7	31				
39642	4	17	7	11	5926	5	12	7	31				
39642	4	17	7	11	17535	5	12	7	31				
30742					3597CR	4	28	7	33				
39642	5	02	7	11	66893	5	12	7	31	220742	3842	416	
39642	5	06	7	11	7925	6	10	7	31				
39642	5	08	7	11	4832	6	10	7	31				
39642	5	15	7	11	16925	6	10	7	31	29170	512		
(Proof of Parallel Balance)					549511					534661	9256	633	4961

Note: Pro Number, although not indicated on the form, appears in the list bank at right of customer number.

ivision 33 Account No.39642

etail	of	Remittance	
ash	Discount	Others	Freight
136929	2351		
81380	1411	217	
66440	1140		4961
220742	3842	416	
29170	512		
534661	9256	633	4961

the form,
ustomer

REPORT #11

THE HALLIDAY COMPANY

S T A T E M E N T

The Waverly Corporation

2134 Hennepin Avenue

Minneapolis

Minnesota

Terms: 2% e.o.m.net 60

TRANSACTION

DEBITS	CREDITS
11-INVOICE	31-REMITTANCE
12-DISC.DEDUCTION	32-DISCT.ALLOWED
13-MDSE.DEDUCTION	33-MDSE.CREDIT
14-FGHT.DEDUCTION	34-FGHT.ALLOWED
15-	35-
16-PROTESTED CHECK	36-OVERPAYMENT
17-	37-PART PAYMENT
18-	38-
19-MISC.DEBIT	39-MISC. CREDIT

Customer Number	Date Mo Day Tran	Debits	Credits	Balance
13482	3 15 11	2567		
13482	3 18 12	298		
13482	3 24 11	24672		
13482	4 10 36		352CR	
13482	4 12 11	19648		
13482	4 15 11	2964		
13482	4 19 33		2058CR	
13482	4 21 11	10526		
13482	4 22 11	3987		
13482	4 22 11	1567	30000CR	
13482	4 22 27			
13482	4 22 11	9628		
	*	75857	* 32410CR	* 43447

Note: The first column proves correctness of customer identity. This column is scored on the statement sheet and is detached before statements are mailed.

REPORT #12

F. H. BROWNING COMPANY

SHOP PAY ROLL Week Ending Dec. 18, 1937

P W Amt	D W Hrs	D W Amt	Add	Ded	Gross Earnings	Deductions OAB	Deductions U Ins	Net Earnings	Clock No
	416	3328	80		3408	34	34	3340	37 301
	400	4500			4500	45	45	4410	37 302
1180	280	2520			3700	37	37	3626	37 303
4384				99760	4144	41	41	4062	37 305
1582	307	2610			4192	42	42	4150	37 306
	400	2460	200		2660	27	27	2606	37 307
3865					3865	39	39	3787	37 308
2946				99850	2796	28	28	2750	37 309
4812					4812	48	48	4716	37 311
	384	2304			2304	23	23	2258	37 312
3159					3159	32	32	3095	37 315
1622	320	3046			4668	47	47	4574	37 316
2852	80	600			3452	35	35	3482	37 317
3000					3000	30	30	2940	37 318
	415	2905			2905	29	29	2843	37 320
2876	141	1156			4032	40	40	3952	37 321
4200			450		4650	47	47	4556	37 322
	400	2800			2800	28	28	2744	37 323

Note: Piece Work Hours are not shown in the report but appear in the first list bank at left of Piece Work Amount.

Dec. 18, 1937

Deductions OAB	U Ins	Net Earnings	Clock No
34	34	3340	37 301
45	45	4410	37 302
37	37	3626	37 303
41	41	4062	37 305
42	42	4150	37 306
27	27	2606	37 307
39	39	3787	37 308
28	28	2750	37 309
48	48	4716	37 311
23	23	2258	37 312
32	32	3095	37 315
47	47	4574	37 316
35	35	3482	37 317
30	30	2940	37 318
29	29	2843	37 320
40	40	3952	37 321
47	47	4556	37 322
28	28	2744	37 323

INTERSTATE LIFE INSURANCE CO.

ORDINARY CODE SHEET

Exhibit 13

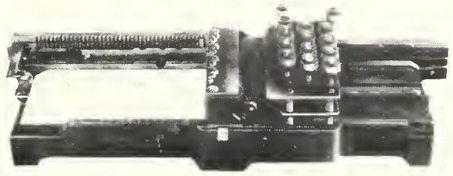
Issue Year	Issue Mo.	Plan	Val. Age	Amount	Premium	Benefit	Rated	Agency	State	Sex / Pay	Clause No. Dis. / D. I.	Premium Dis. / D. I.	Prem. Cse. Dis. / D. I.	Occupation	Girth / Build	Height / True Age	Weight / Family History	Race / Type	Class	Blood Pressure Sys.	Blood Pressure Dias.	Rating Yrs. / $	Rating %	Impairments First	Impairments Second	Other Ins. Chg.	Memoranda

Actuarial O

ORDINARY CODE SHEET

r No.	Issue Year	Issue Mo.	Plan	Val. Age	Amount	Premium	Benefit	Rated	Agency	State	Sex / Pay	Clause No. Dis. / D. I.	Premium Dis. / D. I.	Prem. Cse. Dis. / D. I.	Occupation	Girth / Build	Height / True Age	Weight / Family History	Race / Type	Class	Blood Pressure Sys.	Blood Pressure Dias.	Rating Yrs. $	Rating %	Impairments First	Impairments Second	Other Ins. Chg.	M
0																												
1																												
2																												
3																												
4																												
5																												
6																												
7																												
8																												
9																												
0																												
1																												
2																												
3																												
4																												
5																												
6																												
7																												
8																												
9																												

Actuar



Mechanical Key Punch

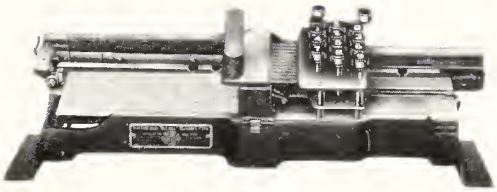
THE Mechanical Key Punch is used to record data on tabulating cards by means of punched holes, thereby preparing accurate, permanent and unalterable records.

No electrical energy is required to operate this machine. Simplicity of design and ruggedness of construction have made it an efficient and economical factor in many installations of the Electric Accounting Method. Two other advantages are its portability and the small amount of space it occupies.

The mechanical key punch has fourteen punching keys, twelve of them corresponding to the twelve positions which can be punched in any one column of the card. The other two are a space key and a release key.

Each individual card is placed by the operator in the carriage of the machine prior to punching. As the punching operation proceeds the machine automatically spaces to the left, thus bringing each column of numerals on the card into the punching position. When the proper information has been recorded in this manner, the operator removes the card, inserts another, and repeats the process.

The punch is so designed that the card column being punched becomes visible immediately following the depression of the key, thus permitting the operator to see what she has punched.



Type 51 Mechanical Verifier

THE Type 51 Mechanical Verifier is used as a mechanical means of proving the accuracy with which the punching operation was performed.

The theory of mechanical verification is identical with that of any checking procedure, viz., that repetition of the work by a different person reveals the errors made by the one who originally performed the task.

The manual operation of the verifier is identical with that of the key punch. The punched card is placed in the verifier and the operator, reading data from the punching source, proceeds as though actually punching. If a key is struck which does not correspond to the hole punched in the card, the carriage of the verifier does not advance, thus calling attention to an error. Comparison of the original data and the punched card is then made to determine whether the error was made in punching or verifying. The verifier is so constructed that the operator cannot see the punched holes to be verified. This, of course, eliminates sight suggestion of correctness.

Mechanical verification greatly reduces the human element hazard in the checking procedure and give definite assurance that the punched hole records are dependably correct.

Type 11 Electric Key Punch

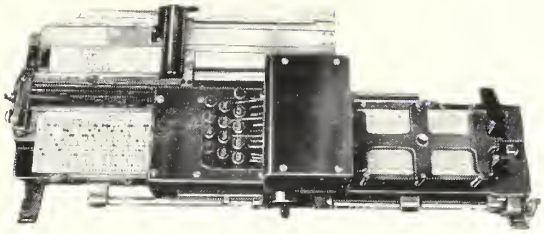
THE Type 11 Electric Key Punch is used to record data on tabulating cards by means of perforations, thereby preparing accurate, permanent and unalterable records for the electric accounting method.

Simplicity of design and ruggedness of construction make this machine a highly efficient device. Its small size enables it to be carried easily from place to place.

The keyboard has fourteen keys, twelve of them corresponding to the twelve positions which can be punched in any one column of the card, the other two being a space key and a release key.

Each individual card is placed by the operator in the carriage of the machine prior to punching. As the punching operation proceeds, the machine automatically spaces to the left, thus bringing each column of numerals on the card in the punching position. When the proper information has been recorded in this manner, the operator removes the card and, after inserting another, repeats the process.

The punch is so designed that the card column being punched becomes visible immediately following the depression of the key, thus permitting the operator to see what has been punched. The limited number of keys and their extremely light touch assure the rapid acquirement of operating skill.



Duplicating Key Punch

THE Duplicating Key Punch is used to record data on tabulating cards by means of punched holes. Information common to more than one card can be recorded automatically; information pertaining to an individual card is recorded by the operator. All the information contained on a tabulating card or any portion of it can be automatically reproduced on other tabulating cards by this device.

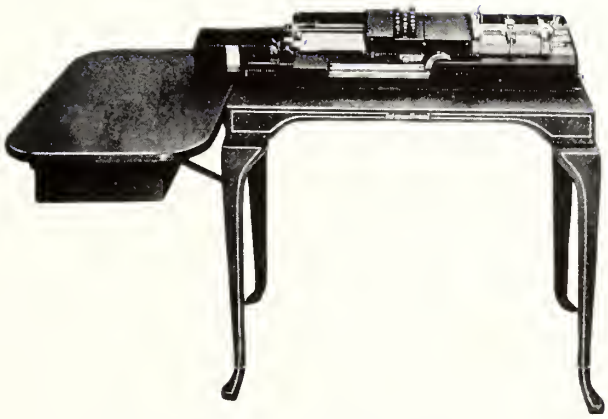
The key board has fourteen keys, twelve of them corresponding to the twelve positions which can be punched in any one column of the card, the other two being a space key and a release key. The duplicating device, which permits the recording of predetermined data, is actuated by a punched card placed in the duplicating card rack. The speed of the duplicating operation is approximately ten columns per second.

This duplicating feature is extremely useful as an automatic coding device. Master cards are pre-punched with all of the codes which pertain to any given set of transactions. Placing the proper master card in the duplicating rack then results in the automatic transfer of these codes in punched form to the detail cards. This not only eliminates individual coding but expedites punching and makes verification of these codes unnecessary.

A stack of unpunched cards is placed in the magazine from which the cards are fed one at a time into the punching mechanism by a hand operated slide. The operation of this slide adjusts the machine for punching. Cards also may be fed into the punch by hand from the left without removing or in any way disturbing those in the magazine.

As each perforation is made, the carriage automatically moves one space to the left until all desired columns on the card have been punched. When the last column has been perforated, the operator removes the card and automatically sets the punching mechanism to repeat the process.

The punch is so designed that the card column being punched becomes visible immediately following the depression of the key, thus permitting the operator to see what she has punched. The small number of keys and their extremely light touch assure the rapid acquirement of skilled operation.



Type 15 Motor Drive Key Punch

THE Type 15 Motor Drive Key Punch is used to record data on tabulating cards by means of punched holes, thus preparing permanent and unalterable records for the electric accounting method.

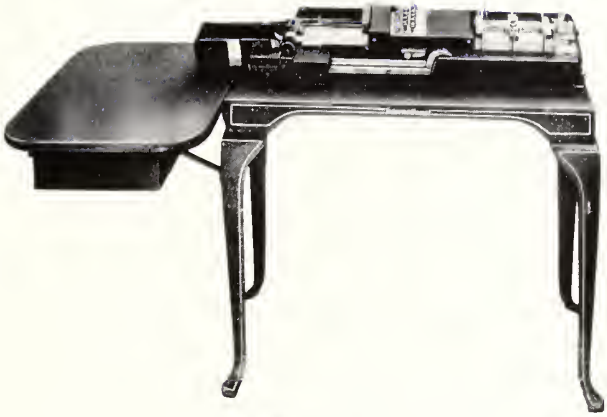
The keyboard has fourteen keys, twelve of them corresponding to the twelve positions which can be punched in any one column of the card, the other two being a space key and a release key. The sloping keyboard is placed at the proper height for convenient operation.

This punch is equipped with automatic card-feeding and card-ejecting devices which are so arranged that after a punched card has been ejected, a card from the magazine is automatically fed into the punching position. Cards may be fed into the punch by hand from the left without removing or in any way disturbing those in the magazine rack.

The operation of this machine is very simple. The only requirement on the operator's part is to press the proper keys; all other movements are automatically performed.

The punch is so designed that the card column being punched becomes visible immediately following the depression of the key, thus permitting the operator to see what has been punched.

The machine is mounted on an attractive, sturdy, steel table. A reading board at the left of the punch provides a convenient place for holding the original written records from which the data are transferred.



Type 52 Motor Drive Verifier

THE Type 52 Motor Drive Verifier is used to prove mechanically the accuracy of data punched in tabulating cards.

The theory of mechanical verification is identical with that of any checking procedure, viz., that repetition of the work by a different person reveals errors made by the person who originally performed the task.

The manual operation of the verifier is the same as that of the key punch. The punched card is automatically fed into the machine and the operator, reading data from the punching source, proceeds as though actually punching. If a key is struck which does not correspond to the hole punched in the card, the carriage of the verifier does not advance, thus calling attention to an error. Comparison of the original data and the punched card is then made to determine whether the error was made in punching or in verifying.

If there are no errors in the punched card it is automatically ejected and the next card is automatically fed into the machine. This automatic feed and eject feature is a great aid in making mechanical verification a highly efficient procedure.

The verifier is so constructed that the operator cannot see the punched holes to be verified. This, of course, eliminates sight suggestion of correctness.

Mechanical verification reduces the human element hazard in the checking procedure and gives definite assurance that the punched hole records are dependably correct.

Type 16 Motor Drive Duplicating Key Punch

THE Type 16 Motor Drive Duplicating Key Punch is used to record data on tabulating cards, by means of perforations, for electric accounting purposes. Information common to more than one card can be recorded automatically; information pertaining to an individual card or any portion of it can be automatically reproduced on other tabulating cards by this device.

The keyboard has fourteen keys, twelve of them corresponding to the twelve positions which can be punched in any one column of the card, the other two being a space key and a release key. The duplicating device, which permits the recording of pre-determined data, is actuated by a punched card placed in the duplicating card rack. The speed of the duplicating operation is approximately ten columns per second.

This duplicating feature is extremely useful as an automatic coding device. Master cards are pre-punched with all of the codes which pertain to any given set of transactions. Placing the proper master card in the duplicating rack then results in the automatic transfer of these codes in punched form to the detail cards. This not only eliminates individual coding but expedites punching and makes verification of these codes unnecessary.

The punch is equipped with automatic card feeding and automatic card ejecting devices which are so arranged that after a punched card has been ejected a blank card is automatically fed into the punching position. Cards also may be fed into the punch by hand from the left without removing or in any way disturbing those in the magazine.

The punch is so designed that the card column being punched becomes visible immediately following the depression of the key, thus permitting the operator to see what has been punched.

The operation of this device is very simple inasmuch as all the operator need do is press the keys to make the desired perforations. All other operations are automatically performed. The automatic features and the limited number of keys assure a rapid acquirement of skilled operation.

The machine is mounted on an attractive, sturdy steel table. A reading board at the left of the punch provides a convenient place for the original records from which the information is being transcribed.

Type 31 Alphabetic Duplicating Key Punch

THE Type 31 Alphabetic Duplicating Key Punch is used to record alphabetic and numerical information in tabulating cards in such a manner that complete words and names, together with numerical data can subsequently be printed by the Alphabetic Accounting Machine.

Information common to more than one card can be recorded automatically; information pertaining to an individual card or any portion of it can be automatically duplicated to other tabulating cards. This duplicating feature is extremely useful as an automatic coding device. Master cards are pre-punched with all of the codes which pertain to any given set of transactions. Placing the proper master card in the duplicating rack then results in the automatic transfer of these codes in punched form to the detail cards. This not only eliminates individual coding but expedites punching and makes verification of these codes unnecessary.

The punching mechanism is controlled by two keyboards, one of which has both alphabetic and numerical keys, arranged to correspond with those of a typewriter. The other is the same as the keyboard of a numerical key punch and is provided for convenience of operation and to attain maximum production.

The Alphabetic Duplicating Key Punch is equipped with automatic feed and eject, and is mounted on an attractive steel table. A reading board at the left provides a convenient place for holding the original records from which the information is being transferred.

Type 33 Alphabetic Duplicating Printing Punch

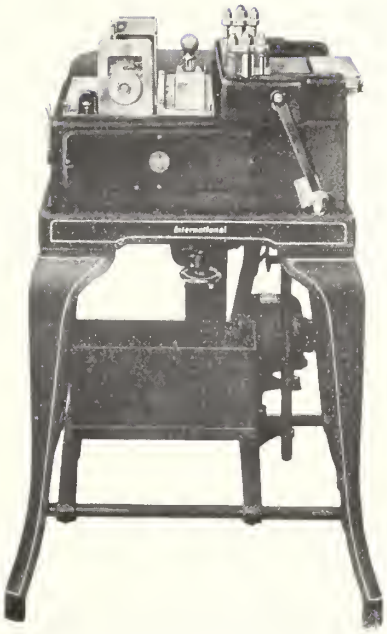
THE Type 33 Alphabetic Duplicating Printing Punch is used to record both alphabetic and numerical data on tabulating cards by means of punched holes, at the same time printing this information along the top of the card. Thus the machine provides a means of interpreting the holes punched for tabulating purposes into legible characters, aiding greatly the checking, filing, or reference operations.

A duplicating device is provided on this machine which permits the recording of predetermined data from master cards. The device is actuated by a punched card placed in the duplicating rack. The speed of the duplicating operation is approximately ten columns per second. This feature is extremely useful as an automatic coding device. Master or code cards are prepunched with all of the codes which pertain to any given set of transactions. Placing the proper master card in the duplicating rack then results in the automatic transfer of these codes in punched form to the detail cards. This not only eliminates individual coding but expedites punching and makes verification of these codes unnecessary.

The operation of this machine is controlled by a standard typewriter keyboard, the feeding and ejecting of the cards being entirely automatic. Tabular inserts are used to automatically control skipping, spacing, duplicating and ejecting of cards.

The machine is mounted on an attractive steel base of a convenient height for operation from a seated position. The large waste receptacle mounted beneath the machine does not limit the ample leg room provided, and the reading board at the left provides a convenient place for the original records from which the information is transcribed.

The Type 33 Alphabetic Duplicating Printing Punch has an extremely light action, every movement being power driven, the keys merely engaging the operating mechanisms.



Type 501 Automatic Numbering Gang Punch

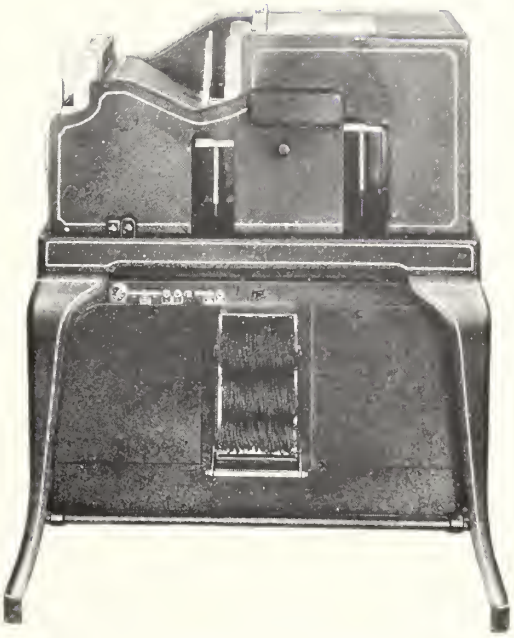
THE Type 501 Automatic Numbering Gang Punch provides an automatic means of recording on tabulating cards all data which is common to a number of cards.

The columns to be punched may be set up in the machine in two ways, by using a prepunched master card, which performs the set-up automatically—or by hand setting each column individually. A combination of both methods may also be used when required.

The operation of this machine is very simple. The operator is required only to place the group of cards in the feed box, set up the punching bars on the columns to be punched by one of the methods described above, and to press the starting button. The machine then punches automatically at the rate of 125 cards per minute.

One important feature of this machine is the card counting device. A dial is set to register the number of cards to be punched; when that quantity has been punched the machine automatically stops. Another feature is the card numbering attachment which is available at a slight additional cost for automatically printing serial numbers or identification numbers on the cards as they are gang punched.

Throughout the entire design of this machine careful consideration has been given to speed, automatic features, and simplicity of operation.



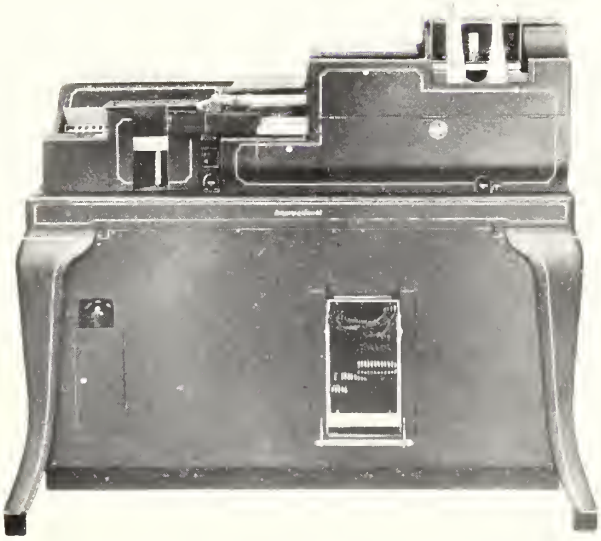
Type 511 Automatic Reproducing Punch

THE Type 511 Automatic Reproducing Punch provides a means for reproducing all or any portion of the information, either numerical or alphabetic, which has been punched in one group of cards into another group of cards. It is also possible to gang punch information from one master card into a desired number of detail cards. All operations are effected automatically, as the master cards pass through the machine.

Both reproducing and gang punching may be accomplished simultaneously; that is, while information is being reproduced into a group of cards, additional data may be gang punched into the same cards from a prepunched master set-up card.

The Automatic Reproducing Punch operates at a constant speed of 100 cards per minute for all types of work, regardless of the number of holes which are punched.

This machine is equipped with an automatic plugboard, similar in principle to a telephone switchboard, by means of which any desired arrangement of data can be obtained from the punched cards. Two types of slides, or set-up panels, may be used with this plugboard: the manual set-up type, with which the set-up of the machine can be changed at any time by the manual rearrangement of the plugboard wires; and the fixed set-up type, which provides a standard set-up at any time, merely by the insertion of a slide with fixed wiring.



Type 600 Automatic Multiplying Punch

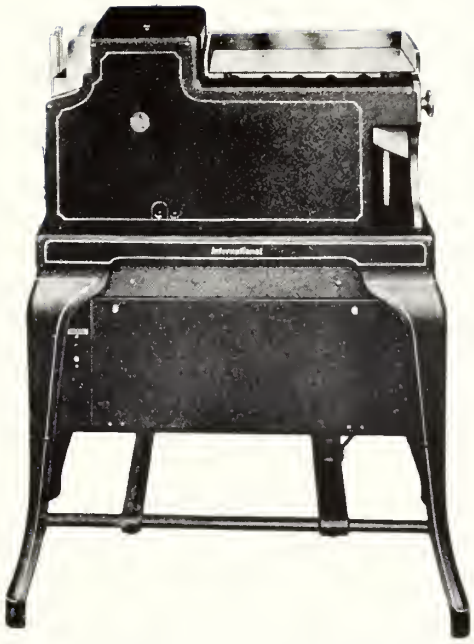
THE Type 600 Automatic Multiplying Punch is used in the electric accounting method for automatically multiplying amounts punched in tabulating cards and punching the products in the cards in any desired position. As the products are recorded on the cards, they may be accumulated by the machine and totaled in a summary counter.

One multiplying factor is always derived from the individual cards but the multipliers may be set up either from each detail card or from master cards inserted or sorted in ahead of classified groups of detail cards, which method provides group multipliers.

Accuracy of punching and extensions may be checked by several different methods, all of which are automatic.

This machine has the capacity for multiplying as many as 8 digits in the multiplicand by 8 digits in the multiplier. Products of 16 digits may be punched, and a 10 digit summary of products accumulated in the summary counter. Each product may be adjusted to any desired number of decimal positions before it is punched in the card or accumulated.

The machine does not multiply by adding; it performs the actual multiplication process, and for that reason is extremely rapid. The speed of the machine, for any multiplicand, is dependent upon the number of digits (other than zeros) in the multiplier, a minimum of 1,000 extensions per hour being made where multiplier factors average 4 digits each.



Type 551 Automatic Check Writing Interpreter

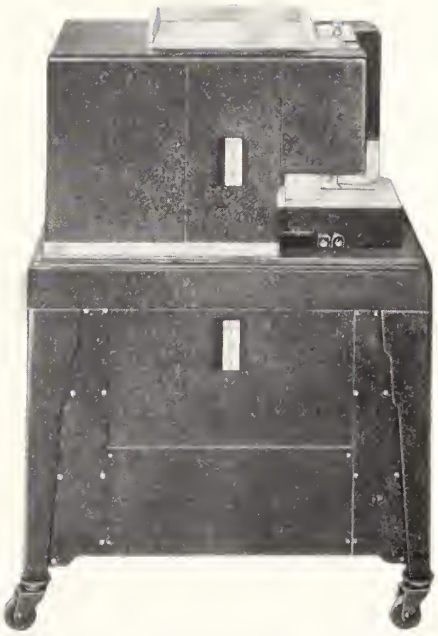
THIS machine is particularly designed for the purpose of translating the holes punched in tabulating cards and printing the resultant numerals in any desired arrangement, in legible form, on the face of regular tabulating cards or on tabulating card checks.

The printing can be accomplished in any one of five positions. The first is at the extreme top of the card, where it is visible in filing and general work, and the lowest position is on a line 1 3/16″ from the top of the card, which is the check-writing position. Between these two are three other equally spaced positions registering exactly between the lines of punching.

Special large pin-point type is used for check writing, giving a clear impression and affording extra protection to the check. Asterisks are automatically printed to cancel any unused positions in the space reserved for dollars, and the amount may be printed in two or more places if desired.

The machine is equipped with a flexible plugboard and will interpret forty-five card columns in one run. A full eighty column card may be interpreted by using two lines of printing.

The Type 551 Automatic Check-Writing Interpreter can be equipped with either the normal or the large type. The speed of this machine is 60 cards per minute.



Type 552 Alphabetic Interpreter

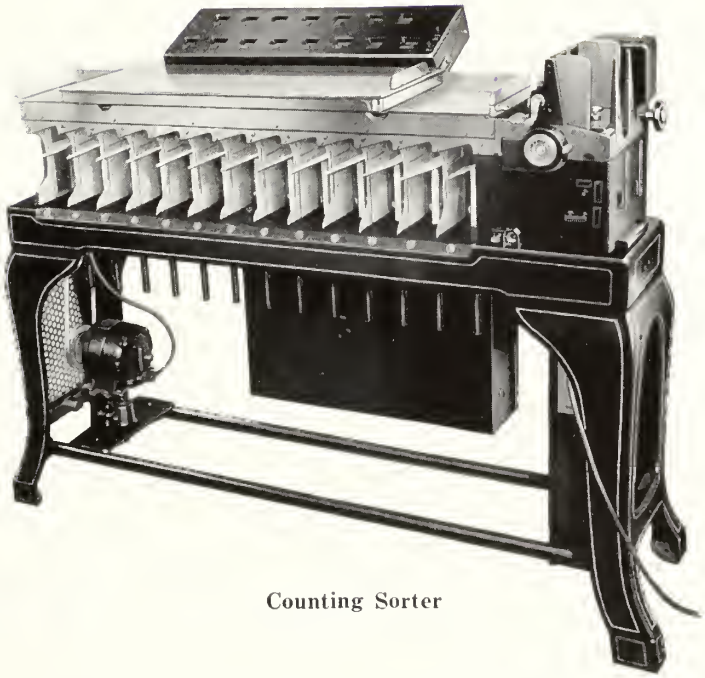
THE Type 552 Alphabetic Interpreter translates the holes punched in a tabulating card by printing on the face of the same card the alphabetic and numerical information which the holes represent.

The printing mechanism of this machine consists of sixty type bars. Each type bar contains ten numerical (0 to 9) characters and a full complement of alphabetic characters.

The sixty characters may be printed in a single row positioned along the top of the card above the 12's or between the 12's and 11's as desired. Should sixty columns of interpreted information be insufficient, the cards may be run through the machine twice so that the additional information is printed in the second position, under the first row.

The speed of this machine is 60 cards per minute.

Pro. No. 4-3



Counting Sorter

THE Counting Sorter is designed for the purpose of simultaneously counting and classifying punched tabulating cards. It is also capable of operating as a regular sorter, without counting, or as a counting mechanism, without sorting.

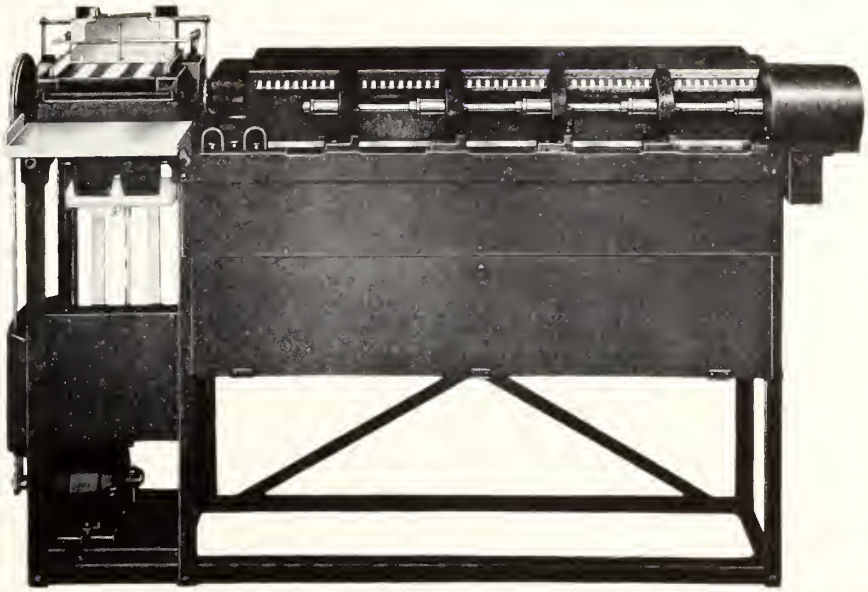
The sorting mechanism has thirteen pockets into which the cards fall during the sorting operation. One is for rejected cards (those having no holes in the column being sorted); the other twelve are for the twelve punching positions in a card column. Each pocket has an 800 card capacity. When this limit is reached in any one pocket, the machine automatically stops to enable the operator to remove the cards.

The adjustable counting mechanism, which will count as many holes as are punched in any one card column, is equipped with fifteen adding counters, one for each of the twelve conditions that can be recorded in a column, one for unpunched cards, one for sub-totals, and one for grand totals. All counters can be cleared in a single operation, or the grand total counter may be allowed to accumulate. Each counter has a 5 digit capacity.

A selecting device enables all cards punched with any particular hole or holes in a single column to be sorted out; the remaining cards pass into the reject pocket without any change in their sequence.

The counting mechanism is located directly behind and above the top of the machine. This makes the figures in the counters readily visible to the operator and a reading board on top of the machine provides a convenient place for transcribing the data.

Throughout the entire design of the Counting Sorter careful consideration has been given to accuracy, speed, quietness, and convenience of operation.



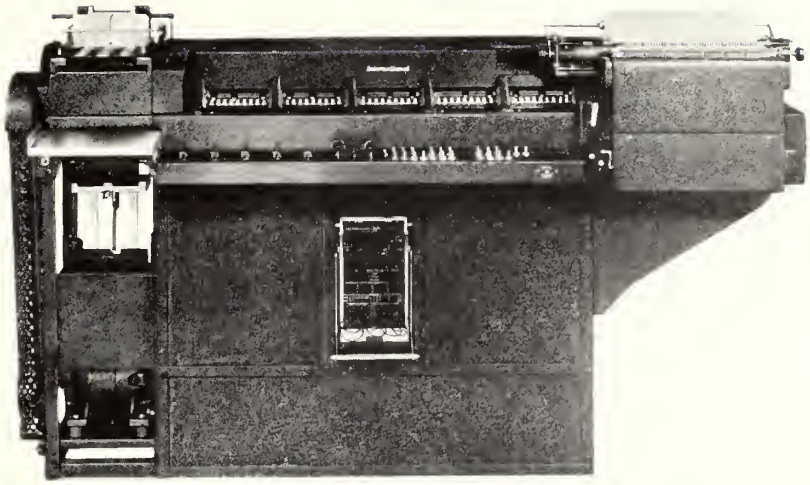
Type 92 Five Counter Tabulator

THE Type 92 Five Counter Tabulator is a multiple adding machine by means of which punched cards are made to yield totals. It determines sub-totals and grand totals and also indicates proper classifications. These accumulations and classifications are shown on reading dials and may be used either for balancing large groups of cards or transferred by the operator to report forms. A reading board, for use as a table in transcribing, may be specified for the machine.

From one to five groups of eight digit figures may be simultaneously added from each card by this machine at the rate of 150 cards per minute; in other words, 45,000 additions an hour can be obtained.

A plugboard, similiar in principle to a telephone switchboard, renders the machine entirely flexible for all tabulating needs. Specially designed stop cards cause the machine to stop at the end of each classification or group so that the operator may record the totals pertaining to that group.

All control keys are so placed that the operator can operate the machine with great convenience.



Type 285 Electric Accounting Machine

THE Type 285 Electric Accounting Machine is a multiple adding, subtracting, classifying and printing machine, which, actuated by punched tabulating cards, produces printed tabulations. It will list details from individual cards or will print designations and totals, net totals and accumulated net totals.

All data recorded on tabulating cards can be compiled to show net totals for each group or classification together with accumulated net totals for all groups. All such compilations can be automatically printed as finished reports.

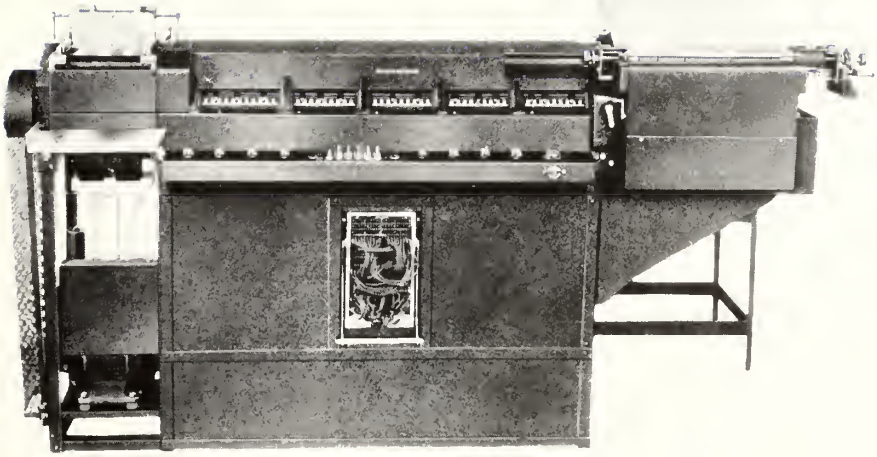
Group totals from as many as five counters can be taken simultaneously, or seven banks of information may be listed at one time, accompanied by five totals. The machine capacities for listing and accumulating vary with the individual models. The machine can be instantly transformed into a Lister which prints in itemized detail the information recorded on the cards and at the same time accumulates the desired quantities, which totals are then printed in their respective positions.

The Type 285 Electric Accounting Machine is equipped with major and minor automatic control which causes the machine to stop momentarily, when classifications change, while the respective totals for the groups are printed on the report. Thus, succeeding groups are automatically tabulated without assistance from the operator.

This machine is equipped with an automatic plugboard, similar in principle to a telephone switchboard, by means of which any desired arrangement of data can be obtained from the punched cards. Two types of slides, or set-up panels, may be used with this plugboard: the manual set-up type, with which the set-up of the machine can be changed at any time by the manual rearrangement of the plugboard wires; and the fixed set-up type, which provides a standard set-up at any time, merely by the insertion of a slide with fixed wiring.

This machine is available in Three, Four, Five, Six, or Seven Bank models, each of which may be equipped with from two to five counters. Counters in any position may be of either adding or balance (direct subtraction) type. These models are supplied with speeds from 75 cards per minute for both listing and tabulating to a listing speed of 120 cards per minute and a tabulating speed of 150 cards per minute.

The simplicity of plugging and the arrangement of all switches and controls in an accessible position along the front of the machine make them particularly convenient to operate.



Type 375 Invoicing Tabulator

THE Type 375 Invoicing Tabulator is especially designed for handling billing on a fully automatic basis. It will prepare completely itemized printed invoices and selection lists, including the totals of quantity, selling price, cost, and weight. Commodity descriptions are printed in a legible and condensed alphabetic form, based on a predetermined analysis of the occurrence of letters.

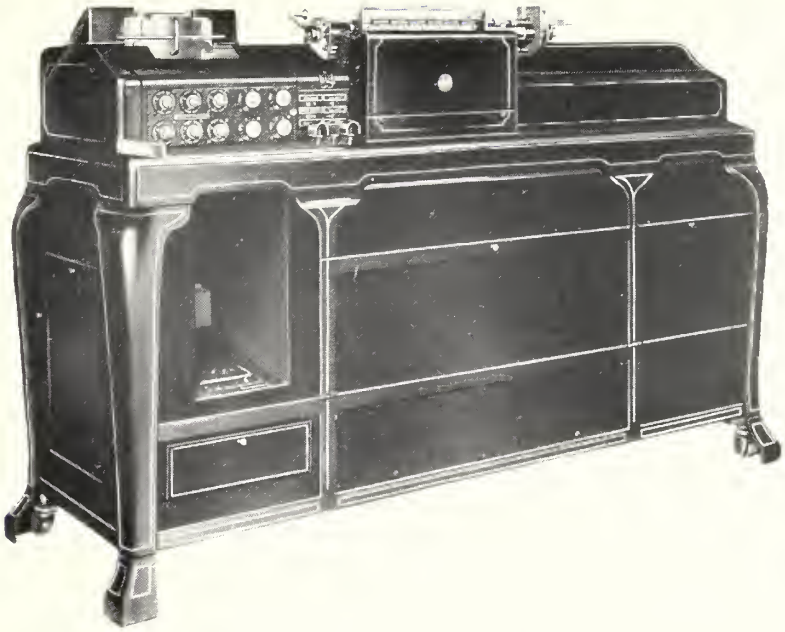
The machine is equipped with a flexible plugboard which facilitates the changing of the machine from the billing arrangement to other required set-ups.

The invoice which this machine is capable of preparing is extremely neat in appearance and compact in size. An office copy in the form of a stub can be prepared in the same operation, thus avoiding the use of carbons.

The machine can be equipped with from three to five counters and a printing unit with from sixty to eighty type bars including those bars reserved for printing commodity descriptions.

This machine is available in four models with speeds of from 75 cards per minute for both listing and tabulating to a listing speed of 120 cards per minute and a tabulating speed of 150 cards per minute. A group selecting device is provided so that maximum machine speed can be obtained for single-card items as well as for multiple-card items.

Pro. No. 7-5 (Revised 2/1/36)



Direct Subtraction Accounting Machine

THE Direct Subtraction Accounting Machine is a combined multiple adding, subtracting and printing machine by means of which punched cards are made to yield printed tabulations. It is used to list details from individual tabulating cards or to print classifications and accumulate and print totals, net totals and accumulated net totals.

All data recorded on tabulating cards can be compiled to show net totals for each group or classification together with accumulated net totals for all groups. All such compilations can be automatically printed as finished reports.

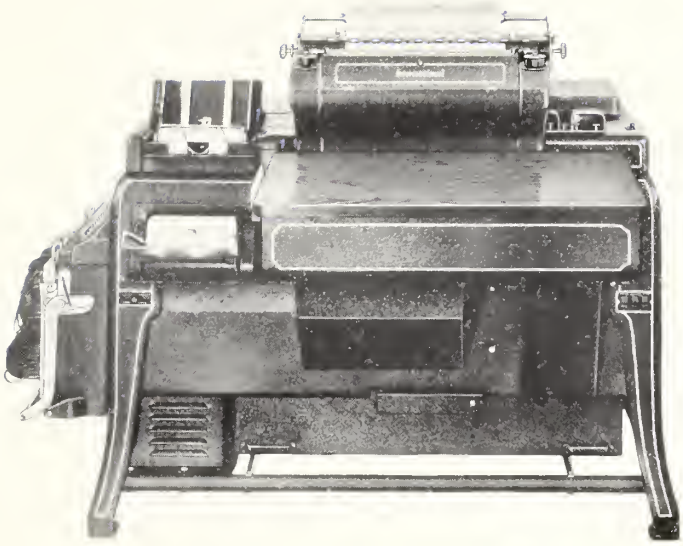
The Accounting Machine can be instantly transformed into a Lister which prints in itemized detail the information recorded on the cards and at the same time accumulates the desired net quantities, which totals are then printed in their respective positions.

Although direct subtraction is the outstanding feature of this machine, many other features make it a highly efficient instrument in accounting procedures. Group totals of from one to six classes of data from each card are secured at a speed of 150 cards per minute. When an itemized list is required, from one to seven classes of data, together with the totals of six, are supplied at the rate of 100 cards per minute.

The machine is equipped with three automatic controls, major, intermediate, and minor, which cause the machine to stop at the end of each group of cards, print the totals or sub-totals for the group on the report, and automatically tabulate the succeeding groups without assistance from the operator. Control switches, levers, card feed, stacker, and carriage are all centralized to permit convenient operation of the machine from one point.

A plugboard, similar in principle to a telephone switchboard, renders this machine entirely flexible for all tabulating needs in the preparation of printed reports. Class selection and balance selection features are other advantages that contribute speed, accuracy and economy to the preparation of finished reports by the electric accounting method.

The entire seven banks of this machine print in a space only thirteen inches wide, thus enabling final reports to be tabulated in a neat, compact manner suitable for any accounting records.



Type 405 Alphabetic Accounting Machine

THE Type 405 Alphabetic Accounting Machine is a combined multiple adding, subtracting, and printing machine by means of which complete printed reports, consisting of both alphabetic and numerical information, may be prepared from punched tabulating cards. It may be used to list both alphabetic and numerical details from individual tabulating cards or to print classifications and accumulate and print totals, net totals, and accumulated net totals.

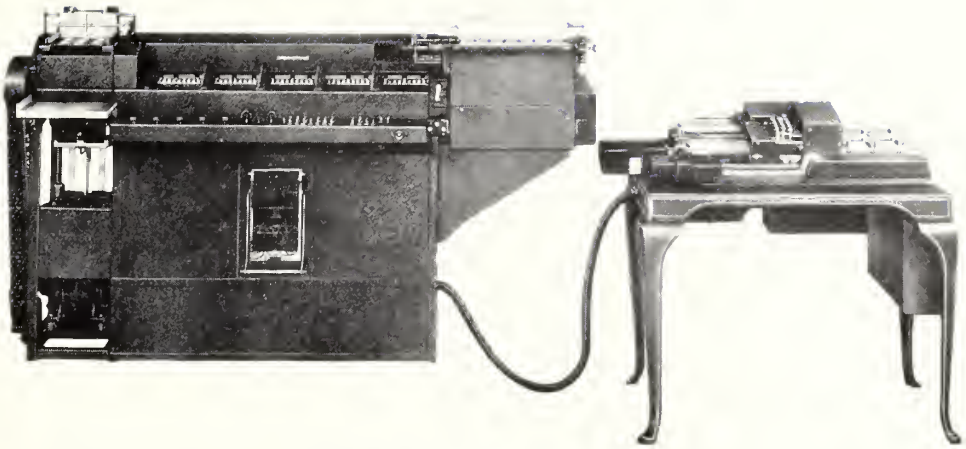
All data recorded on tabulating cards can be compiled to show net totals for each group or classification, together with accumulated net totals for all groups. All such compilations can be automatically printed as finished reports with complete descriptive information.

The machine can be changed instantly into a lister for printing in itemized detail the information recorded on the cards. The data may be printed on printed forms, continuous rolls, or on individual records such as checks, etc. Simultaneously with the printing, the machine accumulates and prints the desired totals.

Listing is accomplished at 80 cards per minute, tabulating at either 80 or 150 cards per minute depending on the model. The machine is equipped with major, intermediate and minor controls, which cause it to stop at the end of each group of cards (whether listing or tabulating), print the total for the group, and automatically proceed with the next classification.

This machine is equipped with an automatic plugboard, similar in principle to a telephone switchboard, by means of which any desired arrangement of data can be obtained from the punched cards. Two types of slides, or set-up panels, may be used with this plugboard: the manual set-up type, with which the set-up of the machine can be changed at any time by the manual rearrangement of the plugboard wires; and the fixed set-up type, which provides a standard set-up at any time, merely by the insertion of a slide with fixed wiring.

The alphabetic feature eliminates typewriter operations and the use of codes in preparing finished reports. Numerals can be interspersed with alphabetic characters. The arrangement of all of the 88 type bars in two continuous banks enables reports to be printed in a very compact form.



Type 516 Automatic Summary Punch

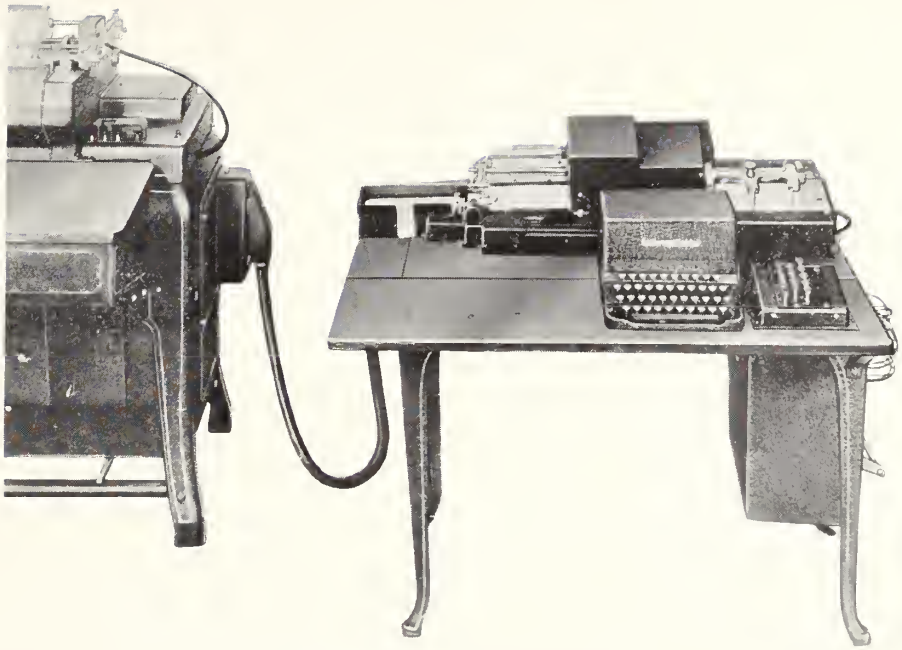
THE Type 516 Automatic Summary Punch is used to punch summary cards from indications and totals appearing in the counters of an accounting machine during the process of tabulation.

The operation of the punch is similar to that of the Motor Drive Duplicating Key Punch except that in addition to receiving impulses from a card in the master card rack and from manual depression of keys, it also receives the impulses from the accounting machine. The two machines can be disconnected by throwing a switch so that they may be operated independently. A plugboard, mounted on the right hand end, renders the summary punch entirely flexible in the transfer of information from the accounting machine.

During the process of tabulation, every control change at which summary cards are to be punched causes the accounting machine to come to a stop, at which time the information contained in the counters of the accounting machine is electrically transmitted to the summary punch and by it, recorded in a tabulating card. Upon completion of the summary punching, the card is automatically ejected and a new one fed into punching position from the magazine. The ejecting and feeding of the cards in the punch occurs simultaneously with the resetting and printing operation of the accounting machine. If the punch runs out of cards an automatic stopping device prevents the accounting machine from starting on the next group.

Information other than that carried in the counters may be recorded on summary cards by either the automatic duplicating or key punching process, ordinarily while the accounting machine is running so that no extra time is required.

The machine is mounted on an attractive, sturdy steel table. All the features incorporated in the motor drive punches are included in this machine.

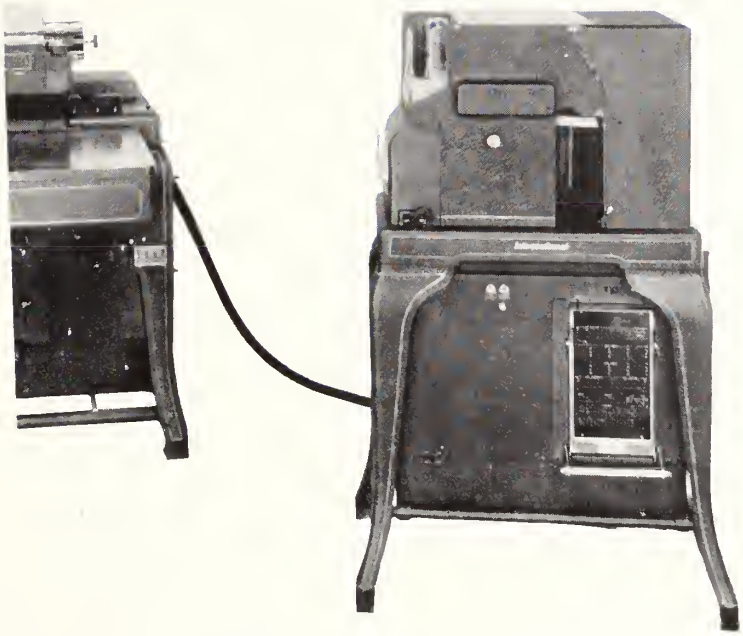


Type 522 Duplicator Summary Punch

THE Type 522 Duplicator Summary Punch is designed for use with the Type 405 Alphabetic Accounting Machine for punching into summary cards the numerical indications and totals appearing in the counters of the accounting machine.

Control changes for which summary cards are desired cause the accounting machine to come to a stop, at which time the information contained in the counters of the accounting machine is electrically read out and transmitted to the summary punch, and by it recorded in a tabulating card. Besides the data taken from the accounting machine counters, the punch will read information common to all cards from a master card in the duplicating rack of the punch and place it in the summary card. This duplicated information may be numerical or alphabetic, while the summary-punched information may be numerical only. Summary punching is accomplished at a speed of 10 card columns per second. Duplicated information is also punched at this rate, but the total time required for summary-punching is generally governed by the number of card columns total-punched, because the punching of duplicated and indicated information is usually completed before a control change.

Although this machine is intended primarily as a summary punch for the alphabetic accounting machine, it can also be operated independently as an alphabetic duplicating key punch; or on units supplied without the alphabetic keyboard, it can be used as a numerical duplicating key punch. In either case its operating principles and functions are similar to those of standard duplicating key punches.



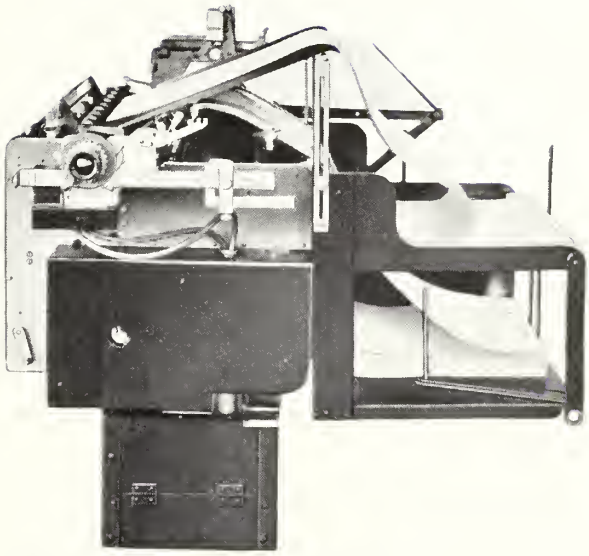
Type 517 Gang Summary Punch
(for use with Type 405 Alphabetic Accounting Machine)

THE Type 517 Gang Summary Punch is a dual function machine, designed primarily to be used as a summary punch for attachment to a Type 405 Alphabetic Accounting Machine, but capable of performing both summary and gang-punching operations.

It is used to punch numerical information into summary cards from indications and totals appearing in the counters of an alphabetic accounting machine during the process of tabulation, and will also punch common information into the cards. It can be operated as a gang punch, performing functions similar to those of the punch unit of the Automatic Reproducing Punch.

In summary punching, control changes at which summary cards are to be punched cause the accounting machine to come to a stop, at which time the information contained in the counters of the accounting machine is electrically read and transmitted to the summary punch, and by it recorded in a tabulating card. Simultaneously with the summary-punching operations, duplicated (gang-punched) data may be punched into the card from a master card. Gang-punched information may be numerical or alphabetic or both. Summary punching is performed at the speed of 1.26 seconds per summary card, regardless of the number of columns punched. A plugboard makes the summary punch entirely flexible in the transfer of information from the accounting machine.

The machine may be operated as a gang punch. When used in this manner it is possible to gang-punch information from master cards into any desired number of detailed cards, with master set-up changes effected automatically. Gang-punched information may be numerical or alphabetic or a combination of both. The machine operates at a speed of 100 cards per minute, regardless of the number of columns punched or the number of punches in a column.



Continuous Form Feed

THE Continuous Form Feed is a device that is attached to either the Invoicing Tabulator or the Accounting Machine for the purpose of automatically handling continuous forms fed through the printing mechanism of the machine.

It provides the advantages arising from the use of single sheets in various phases of accounting work, and in addition yields all the savings of time and labor which result when paper is fed from a continuous roll.

It is adaptable to any accounting procedure that requires individual forms or that is better handled with uniform sheets than with paper torn from a roll, such, for instance, as the preparation of accounts receivable invoices and statements, accounts payable remittance statements, general accounting ledger sheets, insurance agency registers, etc.

This attachment will feed single continuous folded forms or multiple continuous folded forms with carbon interleaved.

Type 921 International Automatic Carriage

THE Type 921 International Automatic Carriage is a special motor-driven device which automatically feeds and spaces continuous forms or roll paper and automatically spaces single sheets. It is designed for attachment to any numerical or alphabetic Electric Accounting Machine. In addition to its many automatic features, it is capable of performing the regular functions of the standard carriage which it replaces.

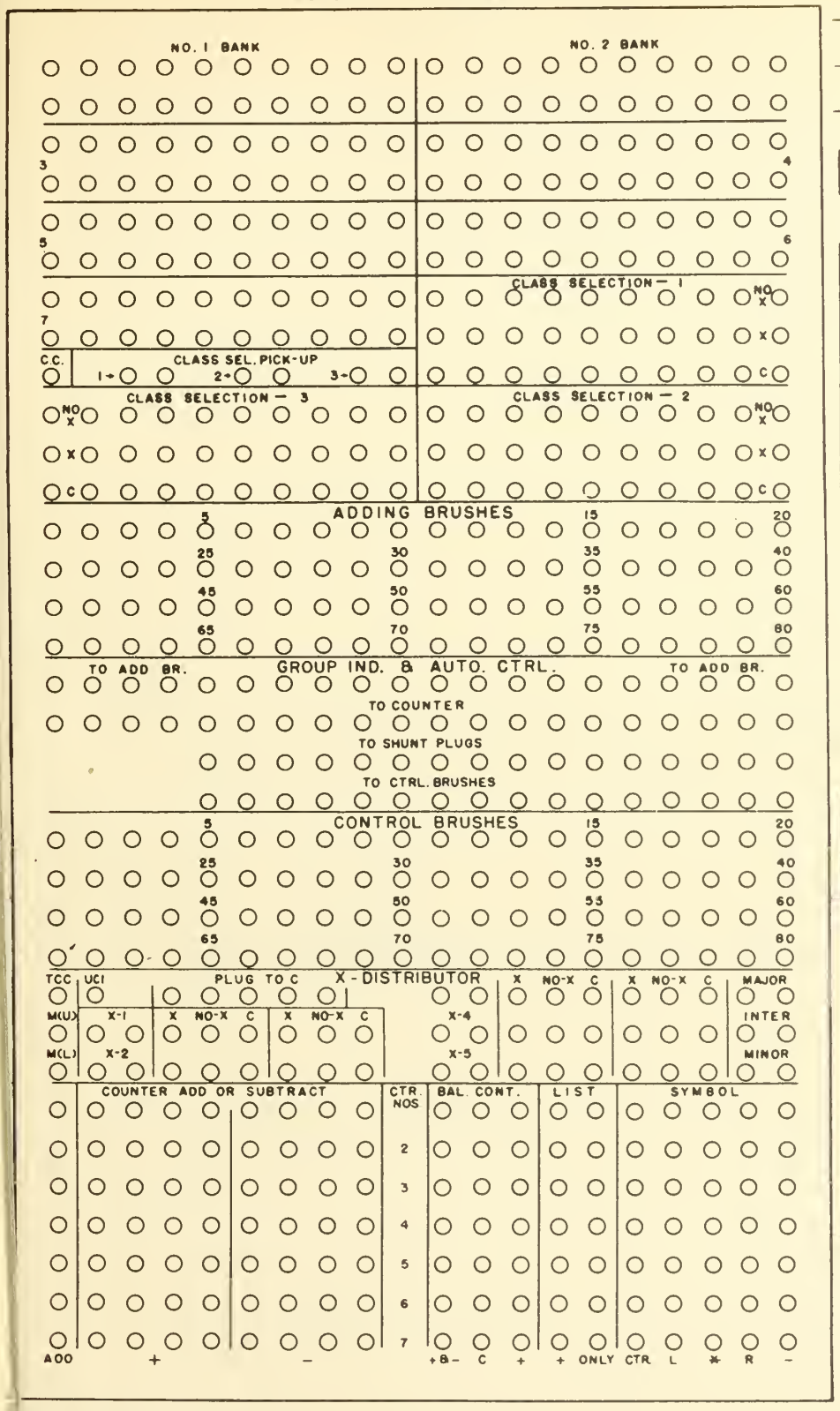
This carriage may be set to eject automatically from a predetermined last line of a continuous form to a predetermined first line of the next form. Or, it may be set to eject from form to form as governed by control changes in the accounting machine.

When this carriage is used on the Alphabetic Accounting Machine, it may be so set that, where heading cards, such as name and address cards, are used, automatic spacing occurs between the last heading card and the body of the form, in addition to the functions noted above.

Single sheets may be handled in the same manner as continuous forms with the exception that they must be hand fed. The sheets may be positioned easily to the first printing line and automatically ejected.

The carriage is equipped with a set of adjustable form guides and feeding and stacking racks for continuous forms. The platen is provided with a special feature which permits adjustment of form position while the carriage is in motion.

TYPE 3 — COMBINATION DIAGRAM — TYPE 4
AUTOMATIC PLUGBOARD



TITLE OF REPORT

TABULATE		LIST	

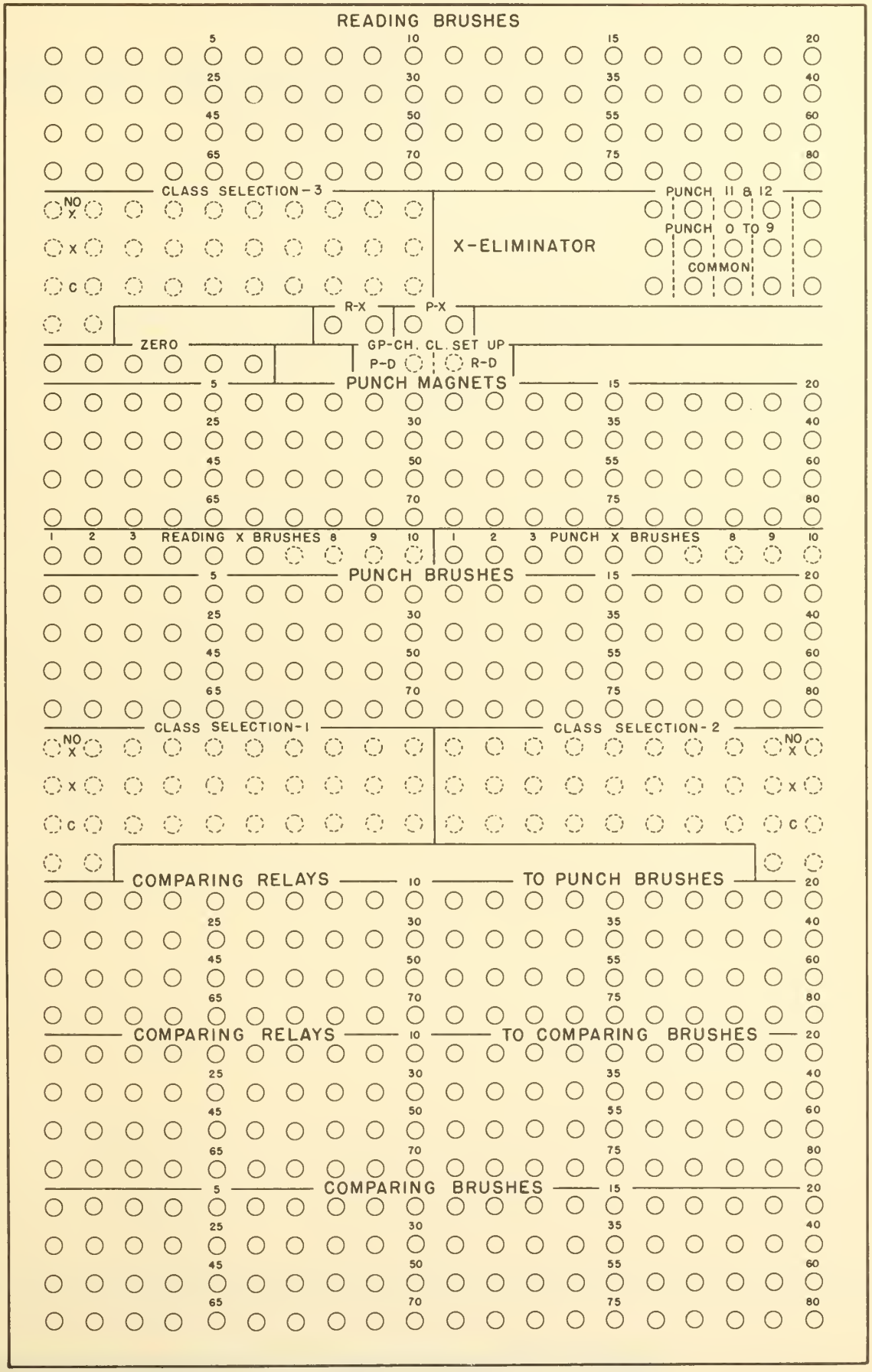
BANK			1	2	3	4	5	6	7
LIST	LIST	OFF							
	IND.	ON							
TOTAL	OFF								
	PROG.								
	MIN.								
	INTER.								
	MAJ.								
BALANCE	OFF								
	ON								

MISC. SWITCHES	OFF	ON
AUTO. START		
AUTO. RESET		
AUTO. CONTROL — MAJOR		
— INTER.		
— MINOR		
GROUP INDICATOR		
SUMMARY PUNCH		
S. P. AUTO. RESET		
S. P. MAJOR		
S. P. INTER.		
S. P. MINOR		
SUCCESSIVE RESET		

REMARKS—

COMBINATION DIAGRAM

INTERNATIONAL REPRODUCING PUNCH & COMPARING REPRODUCER



INTERNATIONAL BUSINESS MACHINES CORPORATION
TABULATING MACHINE DIVISION

270 Broadway, New York

Agreement for

ELECTRIC BOOKKEEPING AND ACCOUNTING MACHINE SERVICE

In the United States

Name ..... No.

Street and No. ..... Date

City and State .....

Service Offered

The International Business Machines Corporation offers to furnish its Electric Bookkeeping and Accounting Machine Service, comprising the use of its machines, devices and equipment listed below, and Cards for use in connection therewith, together with the advice and counsel of its staff in applying the Electric Bookkeeping and Accounting Machine Method to your work, upon the following terms and conditions:

TYPE	DESCRIPTION	QUANTITY	MONTHLY RENTAL EACH

569—100—12-30-36—M&E

Taxes

Taxes now in effect, or if and when levied on the rentals or sales covered in this agreement, are to be added to the rentals and prices.

Period of Contract

This agreement for the aforementioned equipment shall remain in force for One Year from the date the machines, devices and equipment are installed ready for your use, and may be terminated by you or this Corporation then, provided written notice is received three months prior, otherwise this agreement shall remain in full force and effect. Thereafter it may be terminated by you or this Corporation at the end of any calendar month provided three months prior written notice is received or unless terminated by us in accordance with the stipulations of this contract.

Rentals

The rental is to commence in each case on the day following that on which each machine or device is installed ready for your use. Monthly rentals will be invoiced on the first of each month in advance.

The rentals herein provided for are for the use of the machines and for the services rendered to you hereunder.

Additional or Replace Machines

Machines, devices and equipment, in addition to the above, or to replace any you may have in use, will be furnished you in accordance with the conditions of this contract at the rates prevailing at the time your order for same is received.

License to Use

In consideration of the rental paid for the machines, devices and equipment, this Corporation hereby gives you a non-assignable license to use the above machines, devices and equipment, at the place aforesaid for business purposes, and not for experimentation, but such license and any contract based upon the acceptance of this proposition may, at this Corporation's option, be terminated in case of any failure to pay when due the aforesaid rentals of the machines, devices and equipment, or in case any cards are used in the operation of said machines not conforming to the necessary card specifications as follows:

Card Specifications

1. Paper Stock to be as follows:

Coniferous chemical pulp free from ground wood; paper to be substantially free from clay and not to show more than five per cent (5%) ash. Paper to be free from defects due to residual chemicals, slime, carbon or other electrically conducting spots which would cause incorrect operation; and to be manufactured, treated and cured in such a manner as will not necessitate increased servicing of the machines through the accumulation of deleterious matter from cards, will not cause incorrect operation of machines through improper electrical contacts or otherwise, nor interfere with the usual length of life of cards. Paper or cards are to be electrically tested for defects, and defective material rejected. Paper, when cut, to lie flat without curl or wrinkle; and to have smooth even finish and good snap or rattle and a good hard smooth surface on both sides. Paper stock uniform in thickness, viz. 0.0065 of an inch with a limit of plus or minus 0.0005 of an inch.

2. Card Dimensions to be as follows:

Width of all cards to be 3.250 inches with a tolerance of plus 0.007 of an inch or minus 0.003 of an inch.

There are two lengths of cards, i.e. 5.625 inches and 7.375 inches with a tolerance of plus or minus 0.005 of an inch in each case.

The above dimensions apply to cards measured at 50% relative humidity and a temperature of 70° to 75° Fahrenheit.

Edges to be cut square and true and at true right angles. All edges to be free from creases. Corners to be cut as specified ¼ or ⅜ of an inch along top and side. Cards when cut to have the grain of the paper running with the length of the card.

3. Printing to be as follows:

(a) Impression to be legible without excess ink but under no circumstances to indent the card sufficiently to push any part of the surface on either side of the card out of its plane. Such indentations vary the thickness.

(b) Registration. Printed matter to be accurately placed so that the columnar figures will appear properly when tested through appropriate gauges.

In the event of such termination you agree to pay, in addition to the rental already accrued, rental for the machines, devices and equipment at the full rate for the remainder of the contract period covered by this agreement.

Title to Machines

All leased machines, devices and equipment are to remain the exclusive property of this Corporation and may be removed by this Corporation at any time after the termination of said license and contract.

Restriction as to Use

It is agreed that these machines, devices and equipment, will be used only by one shift of clerks, and this Corporation reserves the right to immediately charge, and you agree to pay, double the rental for any machine, device or equipment used by more than one shift of clerks, for the period that the machine, device or equipment is so used; the minimum additional amount to be billed in any such case being one month's rental.

No alterations in, or attachments to, these machines, devices and equipment are to be made by you without the consent, in writing, of an officer of this Corporation, nor are the machines to be used for experimental work or for any purpose not previously disclosed to this Corporation and this Corporation reserves the right in case of any such use to terminate this agreement without notice.

Maintenance

This Corporation will furnish the above machines complete, ready for attachment by you to suitable electric current supply and, except as hereinafter stated, will make at its own expense all necessary repairs to keep the machines in working order, but you agree to bear the expense of making all repairs and replacements and service charges necessitated by your negligence or by the use of cards not conforming to the necessary card specifications set forth herein.

Traveling Expenses

All traveling expenses of our representatives are to be paid by you whether for installing, connecting, repairing or replacing the machines, devices and equipment, unless the machines, devices and equipment, are located at a place where we have a regular representative.

All Previous Agreements

The acceptance of this proposition merges all previous agreements between you and this Corporation for the use of all leased machines, devices and equipment, and the use thereof hereafter is to be subject to this contract, without, however, changing the present monthly rates of payment for their use.

Cards and Supplies

Cards and supplies for use in connection with Electric Bookkeeping and Accounting Machines, will be sold you in accordance with the prices prevailing at the time orders for the same are received.

Transportation Charges

You are to pay all transportation and drayage charges upon all cards, and machines, devices and equipment and parts for repairs or replacements, both to and from our factories.

Packing and Packing Cases

This Corporation will furnish the necessary crates or boxes for the return of all leased machines, devices and equipment or parts of same, without cost, except for transportation charges on same. If desired, this Corporation will furnish a representative to superintend the packing, without charge, except for traveling expenses, the labor for packing to be furnished by you.

You agree to pay the expense of repairing damages done to any machines, devices or equipment returned to us that may have been caused by faulty packing, in cases where our representative does not supervise the packing.

Terms

Thirty days net from date of invoice. No cash discount for prepayment. All orders are subject to acceptance by this Corporation.

INTERNATIONAL BUSINESS MACHINES CORPORATION,
(TABULATING MACHINE DIVISION),

By .....
Authorized Signature

The above proposition is accepted:

Dated .....

.....
Company

By .....

.....
Officer's Title

Economy and simplicity in PROOF WORK

CONTROL is the keynote of the IBM Proof Machine for Banks. It brings to the check divisions a speedier and more comprehensive command of all the phases of their work, reducing the cost of the proving and distributing operations.

Its operation is simplicity itself. It is only necessary for the operator to depress a selection key and to operate an adding machine consisting of only ten keys. The operator depresses the selection key corresponding to the bank on which the check is drawn, lists the amount on the adding machine keyboard, and depresses the release bar with the following results:

1. Check is automatically sorted into proper receptacle.
2. Amount is listed on individual adding machine on single or duplicate tapes, (thus preparing lists for clearing house member banks and other classifications.)
3. Amount is also listed on control tape, together with symbol identifying bank.

When the last check of the deposit has been listed, the operator depresses a total key. The total which appears on the control tape is compared with the deposit slip total. All items, therefore, are under control. Any differences that may have occurred, due to errors by depositors or clerk, are localized for checks are always listed on the control tape in the same sequence as received from depositor.

INTERNATIONAL BUSINESS MACHINES CORPORATION

General Offices
270 BROADWAY
NEW YORK, N. Y.

Offices and Service Stations in Principal Cities of the World

Printed in U. S. A.

NEW PRODUCTS

and

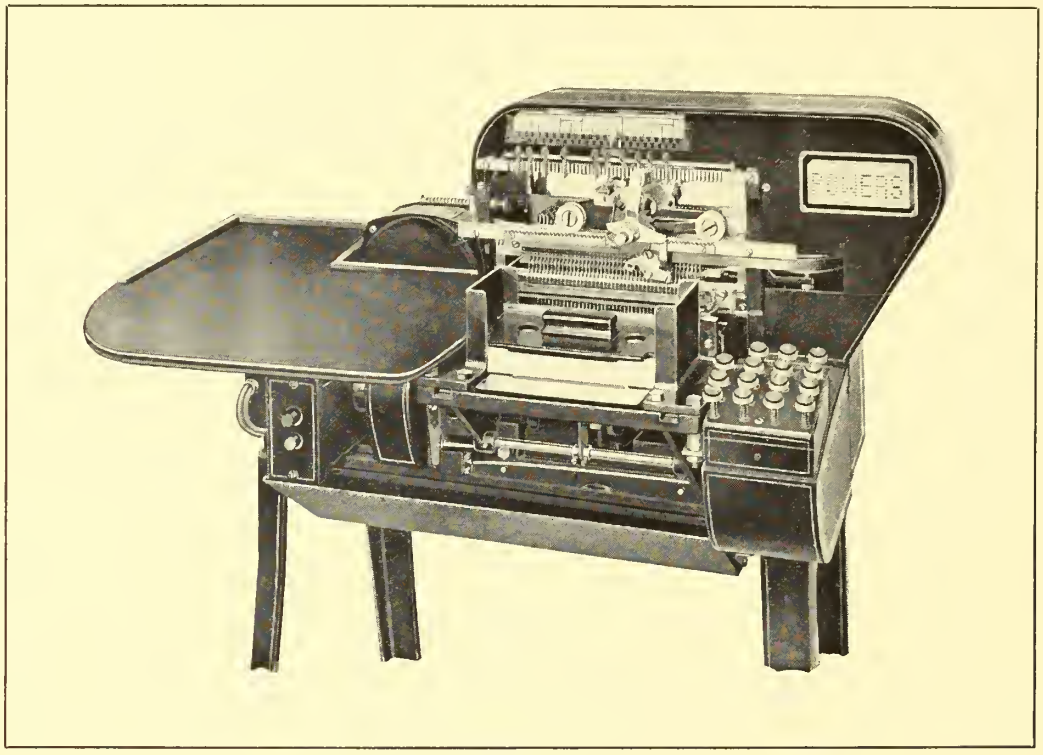
PRODUCT DEVELOPMENT SERIES

This series of bulletins of which the present is a part has for its objective the furnishing of authoritative information with respect to the mechanical specifications and operating advantages of all new products and the further development of present products.

POWERS
AUTOMATIC PUNCH

BULLETIN
P-1

POWERS ACCOUNTING MACHINES
DIVISION OF REMINGTON RAND INC.
Buffalo, N. Y.



POWERS AUTOMATIC PUNCH

THE above illustrates the Powers Automatic Punch. This machine prepares Powers cards by perforating into the latter, information — numerical and alphabetical—essential for accounting details and controls.

Through an exclusive Powers mechanical feature, the information to be punched into the card is first "set up" for the entire card; then, by a simple key depression, the card is automatically punched and ejected. During the punching operation of one card, the succeeding card is mechanically moved into position for punching purposes. No perforation is made until this final operation. Therefore wastage due to spoiled cards is reduced to a minimum—an exclusive Powers feature. The sensitive key action together with locating the keyboard for the operator's convenience results in exceedingly high punching production.

POWERS AUTOMATIC PUNCH

OPERATING FEATURES AND ADVANTAGES

1. Operating of Punching

As in the instance of all Powers Punches, individual holes are not punched as the keys are depressed. Instead, the key action automatically "sets-up" the information in the machine (similar to the setting of keys on an adding machine) and upon the depression of the trip key *all* holes are perforated at one and the same time. This exclusive Powers feature thus allows any correction to be made *before a card is punched.* A "set-up" for an entire card, or any portion thereof, may be thus restored to normal position by the operator who senses that she has struck the wrong key or keys. This feature thus eliminates the necessity for removing a card incorrectly punched, and inserting and repunching a new one as required in other makes of punches.

The present punch, as with all other types of Powers Punches, minimizes "card spoilage," a term expressing the destruction and loss of cards through incorrect punching.

2. Range of Punching

Not only may numerical information be punched by this machine but also alphabetical. Through the use of special combination key tops, this is made possible, and in many instances where the amount of numerical data exceeds alphabetical. Preference is given by users to this type of punch rather than to the Alphabetical Punch.

3. Repeat Punching

Repeat Punching, a feature which materially helps to increase punching production, is also available in this type of punch. The repeat information may be "set" not only in those columns at the left of the card but in fact in any column or columns of the Powers 45 column card.

4 Keyboard

The keyboard has been constructed with a view toward ease of operation, and the assurance of correct manipulation of the keys. The wide spaced keyboard reduces to a minimum the possibility of unintentional double punching in any column through accidentally striking two keys simultaneously.

5. Double Punching

Where more than one hole in a card column is needed, it is possible to deliberately double-punch by depressing two keys simultaneously.

6. Duplicate Punching

As with other Powers Punches, the Automatic Punch has been designed so that after a particular set-up is made in the machine, any quantity of cards, no matter how great, may be fed through the punch automatically at a speed of 100 cards per minute—and each card punched identical with all others. Duplicate punching may be made with respect to the complete or partial set-up of any card as desired.

7. Variable Skip Stops

Variable skip stops are provided to allow the carriage to skip one or more card columns as desired, upon the depression of the skip key. These skip stops may be placed at any column to allow the skipping of any card field. They are so designed that a set-up for one card form may be changed to a set-up for another card form in less than a minute. Each machine comes equipped with ten stops, but more may be obtained if required.

8. Alphabetical Punching

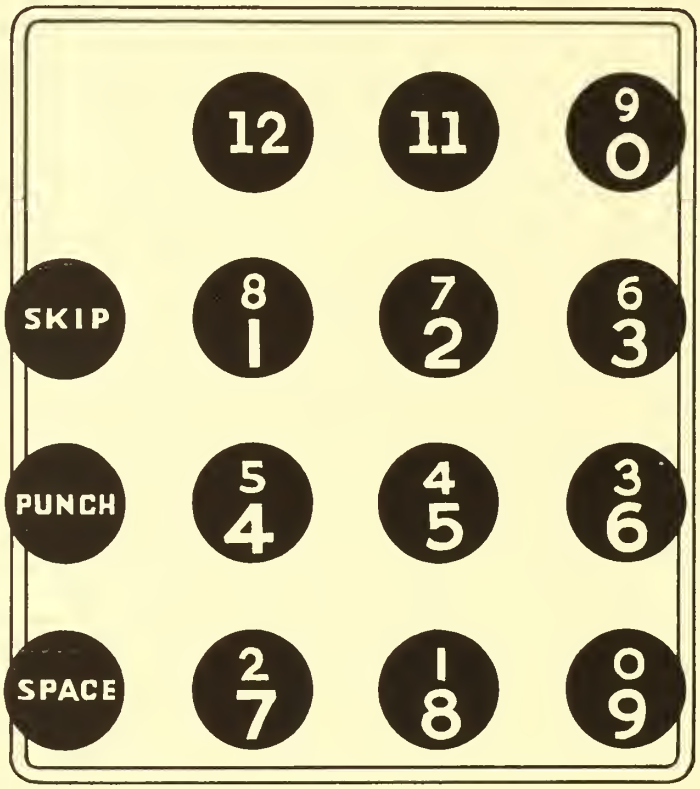
By the substitution of special key tops for the standard numerical key tops, alphabetical punching may be obtained through single and combination key selection.

9. Numbering Device

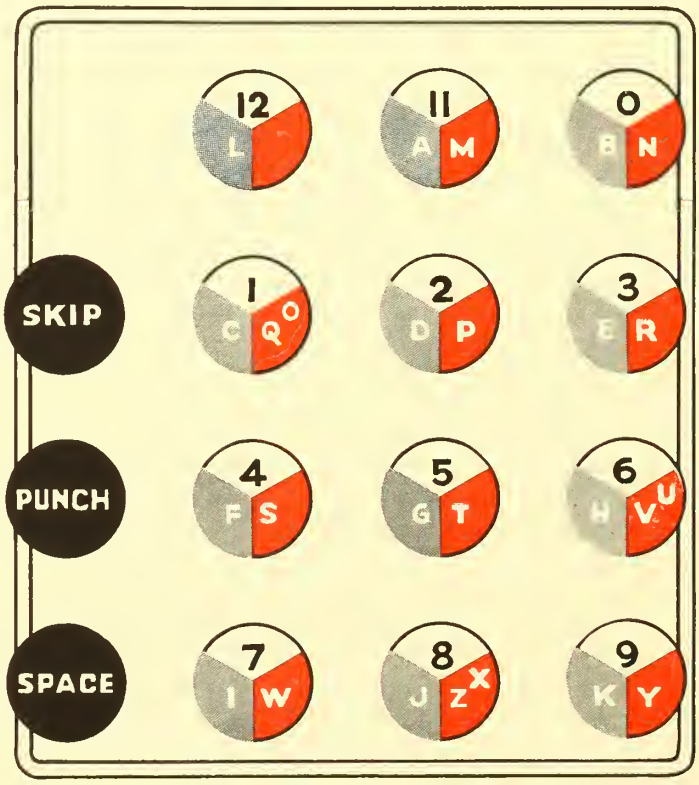
A mechanical numbering device can be attached to the punch for use in stamping numbers on punched cards in serial number order, together with continuous designations. The range of this combination covers eight columns or dials. Usually four are used for serial numbering of cards and the remaining four set to record identical information throughout a given class of punching work.

SPECIFICATIONS

HEIGHT—37".
WEIGHT—177 lbs.
MOTOR SIZE—1/6 H. P.
CURRENT—Either A. C. or D. C.
SPACE OCCUPIED—2'x2' 9".
WORKING AREA—4'x6'.
FEEDING MAGAZINE CAPACITY—600 cards.
FEEDING—Automatic.
TRIP KEY—Mechanical.
CARD NUMBERING DEVICE—Numbering device may be attached as required.
KEYBOARD—Twelve (12) numerical keys, in addition to skip, space and trip key.
KEY ACTION—Mechanical.
COLUMN INDICATOR SCALE—(One) to indicate at all times column position of carriage.
SKIP STOPS—Variable; quick-set.
EJECTION AND STACKING—Automatic.
REPEAT PUNCHING—In any position, column, or field of card.
DUPLICATE PUNCHING—In any or all columns or fields of the card, a speed of 100 cards per minute.
SPECIAL KEY TOPS—Special key tops provided when desired, for alphabetical punching.
SIZE OF READING BOARD—Two sizes—(a) 10"x12" (b) 21"x21".
COLOR—Black with gold striping.



The above is the Powers Standard Numerical Keyboard presented in full size and illustrating the positions of each of the fifteen keys. The wide spacing between keys prevents unintentional double-punching.



The Powers Standard Numerical Keyboard equipped with special key tops which permits in addition to numerical punching, alphabetical punching through single and combination key selection.

P35 PRINTED IN U. S. A. 2M-2-34

NEW PRODUCTS

and

PRODUCT DEVELOPMENT SERIES

This series of bulletins of which the present is a part has for its objective the furnishing of authoritative information with respect to the mechanical specifications and operating advantages of all new products and the further development of present products.

POWERS
90-COLUMN PUNCH

BULLETIN
P-2

POWERS ACCOUNTING MACHINES
DIVISION OF REMINGTON RAND INC.
Buffalo, N. Y.

POWERS 90-COLUMN PUNCH

THE above illustrates the Powers 90-Column Punch. This machine is fully automatic in every way—card-feeding, back-spacing, punching, carriage-returning, and card-receiving. With this machine, both the upper and lower card fields of a 90-column card are punched simultaneously. It is equipped with an electrical keyboard. The sensitive key action of the latter results in high punching production. Further, this punch may be said to be universal by reason of the fact that either a complete 45 or 90 column card or a combination card (i. e., a combination of both 45 and 90) also may be punched.

POWERS 90-COLUMN PUNCH

OPERATING FEATURES AND ADVANTAGES

Operation of Punching

As in the instance of all Powers Punches, individual holes are not punched as the keys are depressed. Instead, the key action automatically "sets-up" the information in the machine (similar to the setting of keys on an adding machine) and upon the depression of the trip key *all* holes are perforated at one and the same time. This exclusive Powers feature thus allows any correction to be made *before a card is punched.* A "set-up" for an entire card, or any portion thereof, may be thus restored to normal position by the operator who senses that she has struck the wrong key or keys. This feature thus eliminates the necessity for removing a card incorrectly punched, and inserting and repunching a new one as required in other makes of punches. The present punch, as with all other types of Powers Punches, eliminates entirely "card spoilage," a term expressing the destruction and loss of cards because of incorrect punching.

Range of Punching

The keyboard of the Powers 90-Column Punch has been so designed that in addition to Powers 90-Column Cards, Powers 45-Column Cards also may be punched by this machine. Through the use of special combination key tops on the 45-column group of keys (which is the first division of the Powers keyboard on this machine) it is also possible to punch "alphabetically." Thus the Powers 90-Column Punch may be said to be a *universal punch* in that it may be used to punch a full 90 or 45 column card, or a combination 45/90 column card — in combination one with the other, and both in combination with alphabetical designations.

Repeat-Punching

Repeat-punching, a feature which materially helps to increase punching production, is also available in this new type of punch. Repeat-punching is possible both in the upper and lower columns of the 90-column card.

Back Spacing

Each division of the keyboard is equipped with an electric back spacing key connected to an electrically operated back spacer. The latter because of its rapid and positive action is of decided advantage to the operator in making corrections in a punching set-up when the occasion demands. As the back spacing takes place the "set-up" is restored to normal and the information in the columns through which the back space has traveled is cancelled. Therefore, the correction is made without loss of card and the time required to re-punch a new card.

Duplicate Punching

As with all other Powers Punches, the Powers 90-Column Punch has been designed so that after a particular set-up has been made in the machine, any quantity of cards may be fed through the punch automatically at a speed of 100 cards per minute, and each card will be punched identical with all others. Duplicate punching can be made with respect to a complete or partial set-up of any card.

SPECIFICATIONS

HEIGHT—37".

WEIGHT—200 lbs.

MOTOR SIZE—1/6 H. P.

CURRENT—Either A. C. or D. C.

SPACE OCCUPIED—2'x2' 9".

WORKING AREA—4'x6'.

FEEDING MAGAZINE CAPACITY—600 cards.

FEEDING—Automatic.

TRIP KEY—Electric.

CARD NUMBERING DEVICE — Numbering device can be attached as required.

KEYBOARD—Designed for both 90 and 45 column cards.

KEY ACTION—Fully electric.

TOUCH—Feather light; $\frac{3}{32}$" key depression for contact.

BACK SPACER—Electric; separate key for each division of keyboard.

SKIP KEY—Electric separate key for each division of keyboard.

COLUMN INDICATOR SCALES—Two; one for upper columns and one for lower columns.

CARD FORM HOLDERS—Two; one for upper columns and one for lower columns.

INTERMEDIATE CARRIAGE RETURN STOP—Variable. Can be set for any one of lower columns.

REPEAT PUNCHING—In any position, column or field of the card.

DUPLICATE PUNCHING — In any or all columns or fields of the card, at a speed of 100 cards per minute.

COLOR—Black with gold striping.

P28A—PRINTED IN U. S. A.—1M-5-35

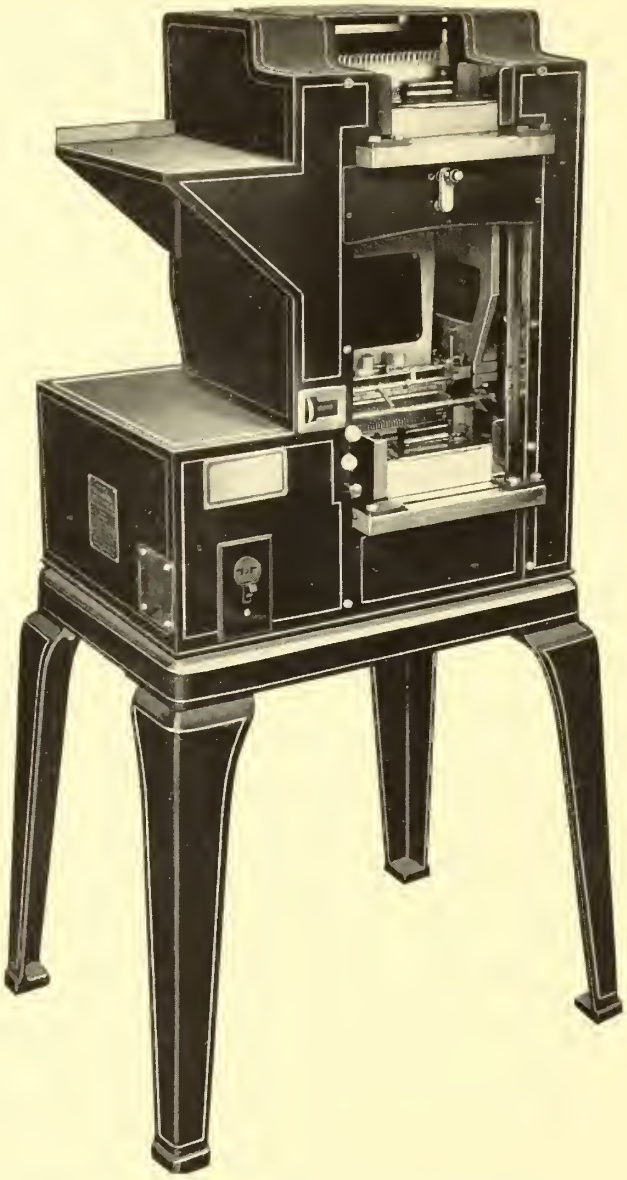
NEW PRODUCTS
and
PRODUCT DEVELOPMENT SERIES

This series of bulletins of which the present is a part has for its objective the furnishing of authoritative information with respect to the mechanical specifications and operating advantages of all new products and the further development of present products.

POWERS REPRODUCING PUNCH

BULLETIN
P-3

POWERS ACCOUNTING MACHINES
DIVISION OF REMINGTON RAND INC.
Buffalo, N. Y.



POWERS REPRODUCING PUNCH

THE purpose of this punch is to reproduce a new set or file of tabulating cards from a present or original set of tabulating cards. This reproduction may be an exact reproduction or it may be modified according to the requirements. Hence, in the process of reproducing, certain card columns and card fields may be eliminated or transposed as required. This machine may also be used as a Duplicating Punch—punching from *one card, any number* of cards containing identical information.

Not only numerical information but alphabetical information also may be reproduced in either the 45 column or 90 column card. The Powers Reproducing Punch is fully automatic in operation and control.

POWERS REPRODUCING PUNCH

OPERATING FEATURES AND ADVANTAGES

1. Variable Automatic Stopping Device

This machine is equipped with an indicator which when properly set will automatically stop the machine when any desired number of cards has been duplicated or reproduced. The maximum range of the indicator—1000 cards.

2. Feeding Magazines Control

Feeding magazines are so controlled that the punch will stop automatically when either magazine is empty.

3. Numbering Device

This machine may be obtained equipped with a numbering device which automatically numbers each card as it is reproduced. The number may be printed in one of two positions.

4. Duplicate Reproduction

Duplicate reproduction is one of the several types of reproducing that this particular machine accomplishes. In this operation, one reproduced card is obtained from each original card.

5. Repeat Reproduction

Not only will this punch reproduce card-for-card, but it will also reproduce any desired number of cards from but one original card—an operation known as repeat reproduction.

6. Converted Reproduction

Another type of reproduction accomplished by this machine is transferring data from an original Powers 45-column card to a Powers 90-column card.

7. Complete Reproduction

All information from an original card may be transferred automatically to a reproduced card. Not only may *all* information, whether numerical or alphabetical be reproduced, but also all control hole punching may also be reproduced.

8. Partial Reproduction

This machine is also designed so that *less than all* information in an original card may be transferred to a reproduced card, i. e. designated card fields and card columns may be omitted when and as desired.

9. Transposed Reproduction

In the operation of reproducing, not only may the information from the original card be transferred to identical fields in the reproduced card, but the information may be reproduced in other fields of the reproduced card.

10. Fully Automatic

This machine is fully automatic in every respect — feeding, punching, numbering and ejecting.

11. Operating Machine

In the design of the machine everything has been arranged for the operator's convenience. The height is ideal, and the feeding magazines for both original and unpunched cards are on the front of the machine.—as are also all controls. The result—no lost time or motion.

12. Universality

Through the use of reproducing translators (an exclusive Powers feature) information in original cards may be transferred and reproduced in card columns different than those in the original card from which the reproduction has been made. Thus it is not required that the arrangement of the card columns of the reproduced card be identical with the columns of the original card.

SPECIFICATIONS

SPEED—150 cards per minute.

HEIGHT—4' 3".

WEIGHT—366 lbs.

MOTOR SIZE—1/6 H. P.

CURRENT—Either A. C. or D. C.

SPACE OCCUPIED—2'x2' 4".

WORKING AREA—4'x6'.

FEEDING—Automatic.

OPERATION—Automatic.

FEEDING MAGAZINES CAPACITY—
Upper magazine 450 cards.
Lower magazine 600 cards.

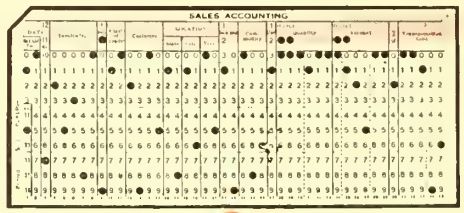
RECEIVING MAGAZINES CAPACITY—
Upper magazine 500 cards.
Lower magazine 1000 cards (with numbering attachment) 500 cards (without numbering attachment).

UNIVERSALITY—Reproduces numerical, alphabetical, and combination of these on either 45 or 90 column cards.

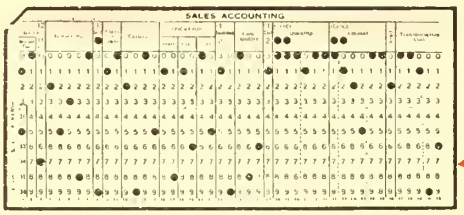
COLOR—Black with gold striping.

CONTROLS—Automatic.

ILLUSTRATIONS OF VARIOUS TYPES OF REPRODUCED CARDS PREPARED BY THE POWERS REPRODUCING PUNCH

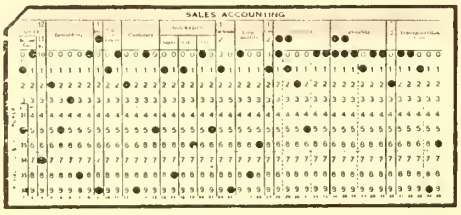


ORIGINAL CARD

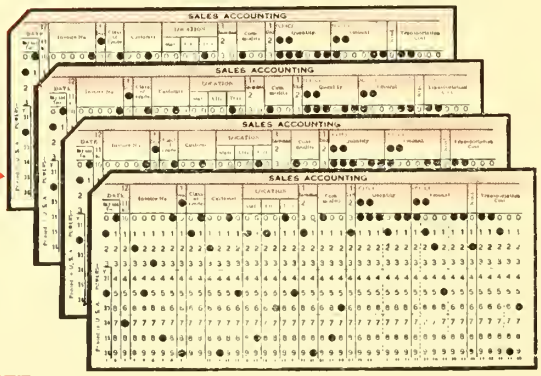


DUPLICATE REPRODUCTION

PARTIAL REPRODUCTION



TRANSPOSED REPRODUCTION



REPEAT REPRODUCTION

POWERS

P43 PRINTED IN U. S. A. 2M 2-34

NEW PRODUCTS
and
PRODUCT DEVELOPMENT SERIES

This Bulletin is one of a series which when bound makes a complete, handy, and authoritative Reference Volume covering the current scope of Powers Accounting Machines and Methods. The solution to your problem is undoubtedly in one of these Bulletins, if not our representative is ready to help you work it out.

REMINGTON RAND
POWERS
PRINTING MULTIPLYING PUNCH

BULLETIN
P-10

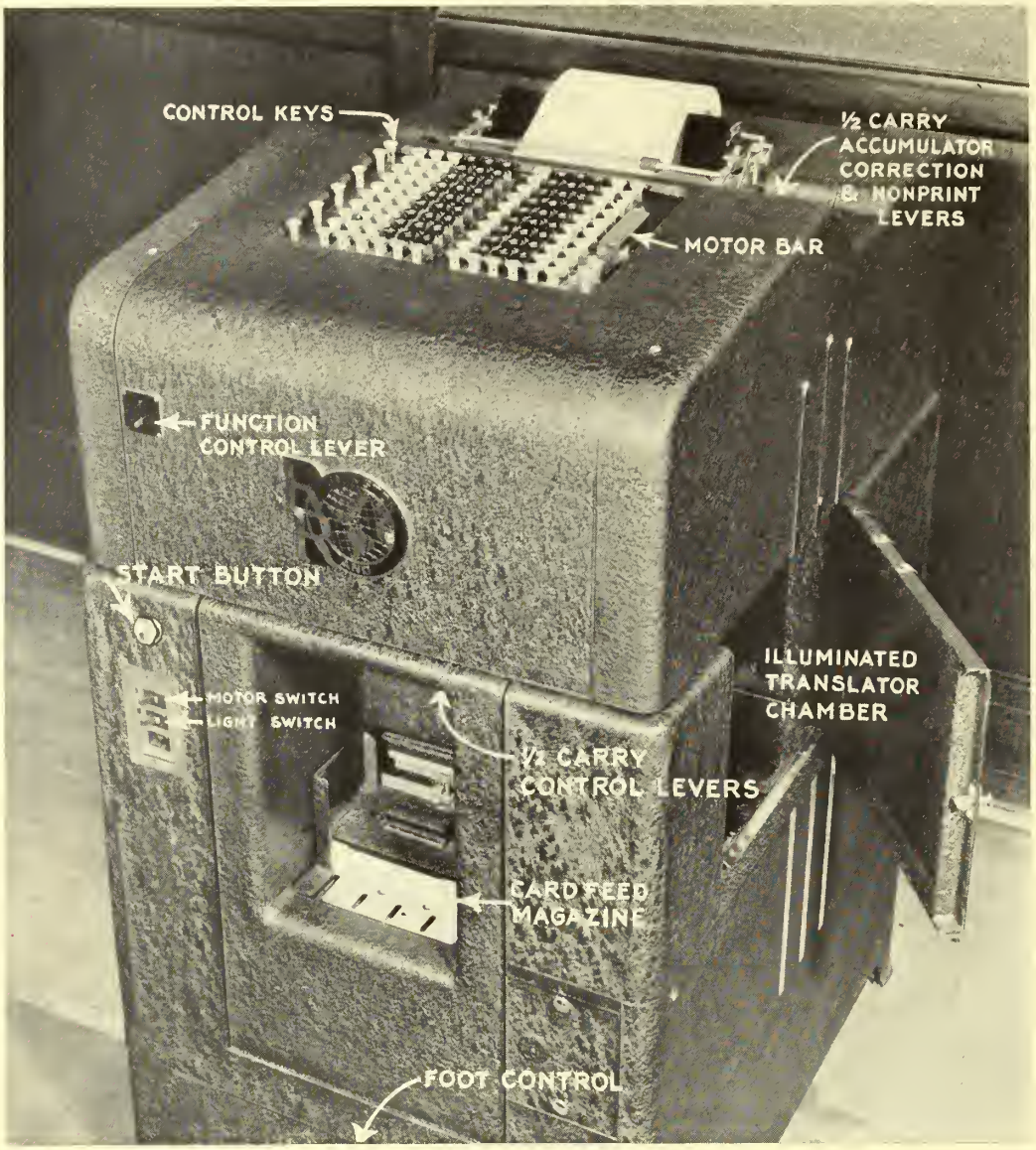
Remington Rand Inc.
Powers Accounting Machine Division
BUFFALO, N. Y.

POWERS

PRINTING MULTIPLYING PUNCH

POWERS

PRINTING MULTIPLYING PUNCH



SPECIFICATIONS

SIZE—46" high, 24" wide, 31" deep.
WORKING AREA—6' 0" wide by 7' 0" deep.
WEIGHT—670 pounds (unpacked).
MOTOR—Alternating or Direct Current. 1/6 H. P.
FINISH—Crackled Black. Chrome Trimming.
CAPACITY—45 or 90 Columns, interchangeably.
Factors—6 digits x 6 digits.
Product—12 digits.
Totals—14 digits.
HALF CARRY—From 2nd, 3rd, 4th, or 5th places in the product.

SPEED—1200 Calculations per hour.

KEYBOARD—Two, Factor Keybanks—6 Keyrows each.
Clear Keys for each row, also Master Clear Keys for each Factor Keybank.
Decimal Indicator Strips.
Automatic Ribbon Reverse.
Keyboard Cover with writing surface and pencil rack.
Motor Bar for "Calculating Head Only" operation.

COLUMN LOCKOUTS—Full 90 column punching Lockouts.

OPERATING FEATURES

Progressive Totals; Final Net Totals; Non-Add Control; Subtract Control; Automatic, Group Calculation Control; Automatic, Clear and Stop Control; Recording Tape with Complete or Partial Non-print Control; Interconnected "Start and Stop Button" and "Foot Control"; Illuminated, Translator Chamber; Progressive Total, Net Total, Non-add and Subtract characters print and punch; Operation is Automatic, Manual or Combined.

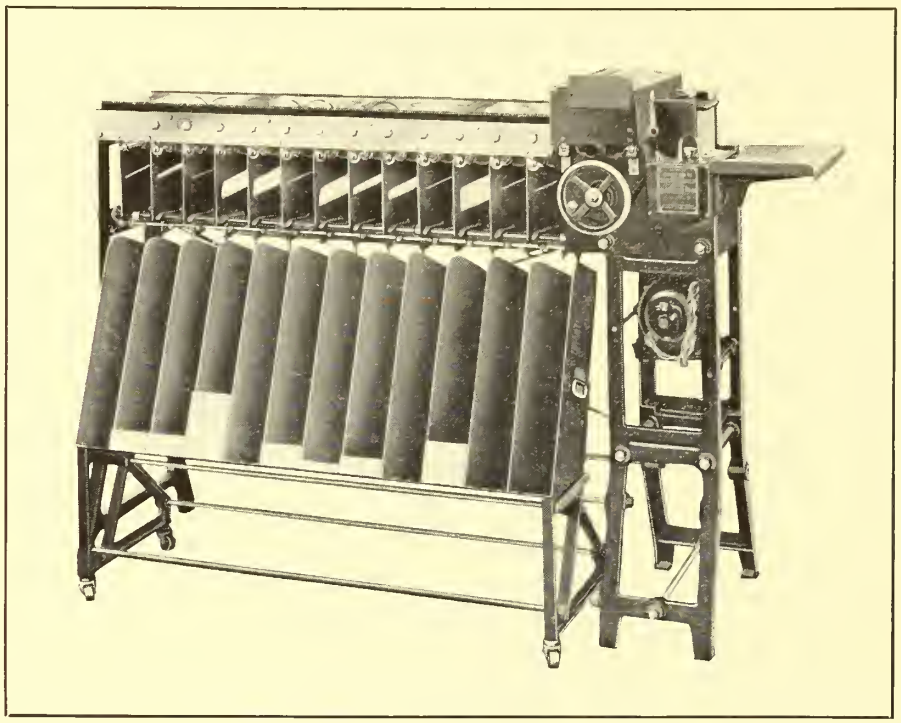
NEW PRODUCTS
and
PRODUCT DEVELOPMENT SERIES

This series of bulletins of which the present is a part has for its objective the furnishing of authoritative information with respect to the mechanical specifications and operating advantages of all new products and the further development of present products.

POWERS STANDARD SORTER

BULLETIN
S-1

POWERS ACCOUNTING MACHINES
DIVISION OF REMINGTON RAND INC.
Buffalo, N. Y.



POWERS STANDARD SORTER

THE Powers Standard Sorter mechanically selects and arranges Powers cards in any desired order at the rate of 420 cards per minute. The task of sorting with this machine as with other types of Powers sorters is mechanical. The operator's task is merely that of indexing the column to be sorted and placing the punched cards in the feeding magazine. By simply depressing a button, this sorter accomplishes in minutes what would ordinarily require hours by any other method.

Every refinement of design in mechanical action as well as perfection in construction has been embodied in the Powers Standard Sorter. Its height is ideal from the standpoint of the operator's convenience—no fatiguing postures such as bending or stooping forward are necessary in operating the machine.

This sorter is equipped with a heavy plate glass top which extends horizontally almost the full length of the machine, just above the card receiving magazines. Thus is afforded a convenient surface upon which to place tabulating cards during the sorting operation.

An auxiliary to this machine is the Powers Sorting Rack mounted on a rolling truck. This rack, of twelve compartments, is made entirely of steel and is so designed that it may be placed in position under the receiving magazines of the sorter, and at the completion of the sorting operation, then easily rolled to that point where the next operation is to be performed.

POWERS STANDARD SORTER

OPERATING FEATURES AND ADVANTAGES

1. General Design

This machine, like all other types of Powers sorters, has been designed with a view toward ease of operation, a minimum of clerical attention, and high sorting production.

2. Controls

The Powers Standard Sorter is equipped with those positive controls required to make the machine fully automatic. When any one receiving magazine reaches capacity, the feeding of cards automatically ceases. Should a card jam occur through faulty operation on the part of the operator, the machine stops instantly. When the last card leaves the feeding magazine, the machine automatically comes to a stop.

3. Capacity of Receiving Magazines

Each receiving magazine has been designed for a capacity of 450 cards. Careful studies have shown this number of cards to be the greatest number that an operator can conveniently handle and efficiently remove from a receiving magazine while the sorter is in operation.

4. Operating Machine

Because of the number of positive controls with which this sorter is equipped, the undivided time and attention of the person operating it is not required. Thus one person may at one and the same time efficiently operate *more than one* Powers Sorter.

5. Selector

Sensing, or selecting, card positions so that cards will fall into their proper receiving magazines is accomplished in this machine by what is termed a selector. This selector is equipped with twelve selecting pins—one each for the twelve positions of a column.

6. Indexing

Indexing, the name given to the operation of setting the machine to sort on the column desired, is accomplished easily and quickly. By simply depressing a releasing latch, the selector may be moved into position for sorting on any one of the 45 columns of the card. The position of the selector at all times is known to the operator through means of the column indicating scale with which each machine is equipped.

7. Split or Selective Sorting

At times it is necessary or advisable to select or sort certain card positions of a column, and reject others. This operation is known as split or selective sorting. Through a very simple movement, it is possible to make any or all pins in the selector inoperative. Pins in normal position will select the proper card positions and cards will fall in their respective receiving magazines. When one or more pins are made inoperative, however, then the corresponding card positions are not selected or sensed, and cards punched in those particular positions pass into the reject magazine without disturbing the *original* arrangement or order of those cards so rejected.

SPECIFICATIONS

SPEED—420 cards per minute.

HEIGHT—39½".

WEIGHT—318 lbs.

MOTOR SIZE—1/6 H. P.

CURRENT—Either A. C. or D. C.

SPACE OCCUPIED—2'x5' 4".

WORKING AREA—4'x8'.

FEEDING MAGAZINE CAPACITY—600 cards.

RECEIVING MAGAZINE CAPACITY—450 cards each.

ARRANGEMENT OF RECEIVING MAGAZINES—Horizontal.

NUMBER OF RECEIVING MAGAZINES—13.

CARD COUNTERS—This type of sorter may be equipped with a card counter for each magazine and also group and grand total counters.

AUTOMATIC STOPPING DEVICE—For each of the 13 magazines.

SORTING ACTION—Regular and split (or selective) sorting.

CARD JAM SHUT-OFF—Automatic.

COLOR—Black with gold striping.

POWERS

P39—PRINTED IN U. S. A.—2M·4·34

NEW PRODUCTS

and

PRODUCT DEVELOPMENT SERIES

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POWERS 90-COLUMN SORTER

BULLETIN
S-2

POWERS ACCOUNTING MACHINES
DIVISION OF REMINGTON RAND INC.
Buffalo, N. Y.

POWERS 90-COLUMN SORTER

THE above illustrates the Powers 90-Column Sorter which mechanically selects and arranges Powers cards in any desired order at the rate of 400 or more cards a minute. This particular machine is so designed that not only may Powers 90-column cards be sorted thereby but also (through a simple movement of a lever) any 45-column card. The task of sorting with this machine, as with all other types of Powers Sorters, is mechanical. The operator's task is merely that of indexing the column to be sorted, and placing the punched cards in the feeding magazine. When the starting button is depressed, the Powers Sorter accomplishes in minutes what would ordinarily require hours by any other method.

POWERS 90-COLUMN SORTER

OPERATING FEATURES AND ADVANTAGES

General Design

This machine, like all other types of Powers Sorters, has been designed with a view toward ease of operation, a minimum of clerical attention, and high sorting production.

Controls

The Powers 90-Column Sorter is equipped with those positive controls required to make the machine fully automatic. When any one receiving magazine reaches capacity, the feeding of cards automatically ceases. Should a card jam occur through faulty operation on the part of the operator, the machine stops instantly. When the last card leaves the feeding magazine, the machine automatically comes to a stop.

Capacity of Receiving Magazines

Each receiving magazine has been designed for a capacity of 450 cards. Careful studies have shown this number of cards to be the greatest number that an operator can conveniently handle and efficiently remove from receiving magazines while the sorter is in operation.

Operating Machine

Because of the number of positive controls with which this sorter is equipped, the undivided time and attention of the person operating it is not required. Thus one person can at the same time efficiently operate *more than one* Powers Sorter.

SPECIFICATIONS

SPEED—400 cards per minute.

HEIGHT—39½".

WEIGHT—318 lbs.

MOTOR SIZE—1/6 H. P.

CURRENT—Either A. C. or D. C.

SPACE OCCUPIED—2'x5' 4".

WORKING AREA—4'x8'.

FEEDING MAGAZINE CAPACITY—600 cards.

RECEIVING MAGAZINES CAPACITY—450 cards each.

ARRANGEMENT OF RECEIVING MAGAZINES—Horizontal.

NUMBER OF RECEIVING MAGAZINES—13.

CARD COUNTERS—This type of sorter may be equipped with a card counter for each magazine and also group and grand total counters.

AUTOMATIC STOPPING DEVICE—For each of the 13 magazines.

SORTING ACTION—Regular and split (or selective) sorting.

CARD JAM SHUT-OFF—Automatic.

UNIVERSALITY—Will sort both 90 and 45 column cards.

COLOR—Black with gold striping.

P26 PRINTED IN U. S. A.--2M-4-34

NEW PRODUCTS

and

PRODUCT DEVELOPMENT SERIES

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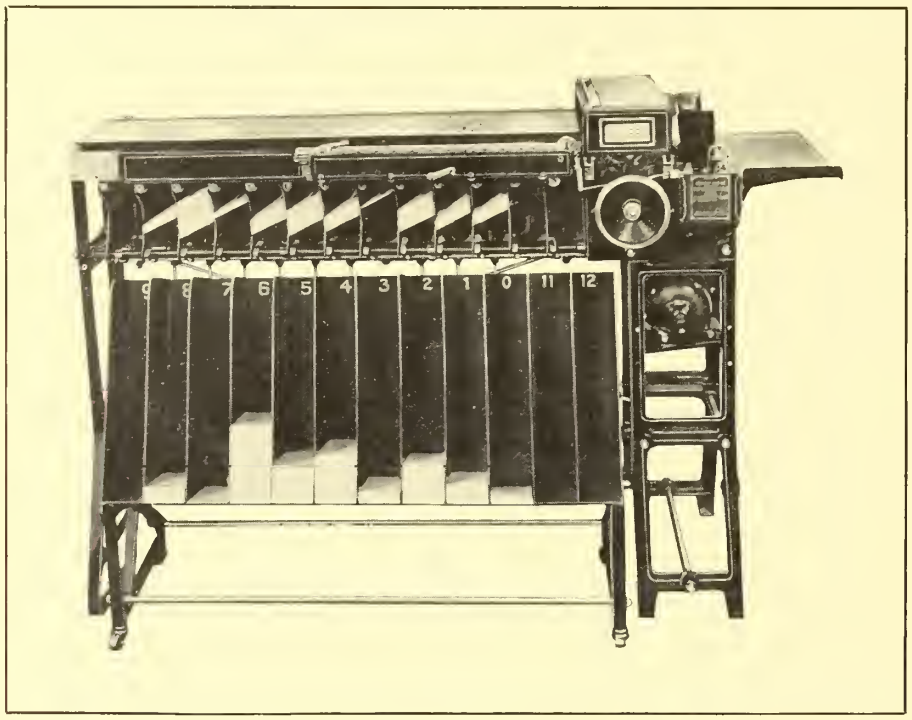
POWERS COUNTING SORTER

BULLETIN
S-3

POWERS ACCOUNTING MACHINES
DIVISION OF REMINGTON RAND INC.
Buffalo, N. Y.



POWERS COUNTING SORTER

THE Powers Counting Sorter, illustrated above, mechanically selects and arranges Powers cards in any desired order. Card counting is obtained automatically either at the same time the selection is being made or without selection if desired, through individual counters for each receiving magazine. In addition to the individual magazine counters, this machine is also equipped with subtotal and grand total counters. This machine is so designed that it will accommodate either 45 column cards, 90 column cards, or both.

The task of sorting and counting with this machine is mechanical. When the starting button is depressed, the Powers Counting Sorter accomplishes in minutes what would ordinarily require hours by any other method. The operator's task is merely that of indexing the column to be sorted and/or counted, placing the punched cards in the feeding magazine and transcribing the totals accumulated in the counters at the end of the sort.

An auxiliary to this machine is the Powers Sorting Rack mounted on a rolling truck. This rack, of twelve compartments, is made entirely of steel and is so designed that it may be placed in position under the receiving magazines of the sorter.

POWERS COUNTING SORTER

OPERATING FEATURES AND ADVANTAGES

1. General Design

This machine, like all other types of Powers sorters, has been designed with a view toward ease of operation, a minimum of clerical attention, and high sorting production.

2. Controls

The Powers Counting Sorter is equipped with those positive controls required to make the machine fully automatic. When any one receiving magazine reaches capacity, the feeding of the cards automatically ceases. Should a card jam occur through faulty operation on the part of the operator, the machine stops instantly. When the last card leaves the feeding magazine, the machine automatically comes to a stop.

3. Capacity of Receiving Magazine

Each receiving magazine has been designed for a capacity of 450 cards. Careful studies have shown this number of cards to be the greatest number that an operator can conveniently handle and efficiently remove from a receiving magazine while the sorter is in operation.

4. Selector

Sensing, or selecting, card positions so that cards will fall into their proper receiving magazines is accomplished in this machine by what is termed a selector. This selector is equipped with twelve selecting pins—one each for the twelve positions of a column.

5. Card Counters

Each receiving magazine from 0 to 12 inclusive is equipped with an individual counter, each counter havng a capacity of 9999. Sub and Grand Total Counters are also provided and have a counting capacity of 99999 for each. The individual counters register the number of cards going into a particular receiving magazine. The Sub Total counter registers the number of cards going into a group of receiving magazines while the Grand Total Counter, registers the total number of cards passing through the machine in one or more selections.

6. Card Counting

This machine is equipped with a latch to hold open the gate of the 12th position receiving magazine so that all punched card positions within a column can be counted without disturbing the sequence or arrangement of the cards.

7. Indexing

Indexing, the name given to the operation of setting the machine to sort on the column desired, is accomplished easily and quickly. By simply depressing a releasing latch, the selector may be moved into position for sorting on any one of the 45 or 90 columns of the card. The position of the selector at all times is known to the operator through means of the column indicating scale with which each machine is equipped.

SPECIFICATIONS

SPEED—420 cards per minute.

HEIGHT—39½".

WEIGHT—318 lbs.

MOTOR SIZE—1/6 H. P.

CURRENT—Either A. C. or D. C.

SPACE OCCUPIED—2'x5' 4".

WORKING AREA—4'x8'.

FEEDING MAGAZINE CAPACITY—600 cards.

RECEIVING MAGAZINE CAPACITY—450 cards each.

ARRANGEMENT OF RECEIVING MAGAZINES—Horizontal.

NUMBER OF RECEIVING MAGAZINES—13.

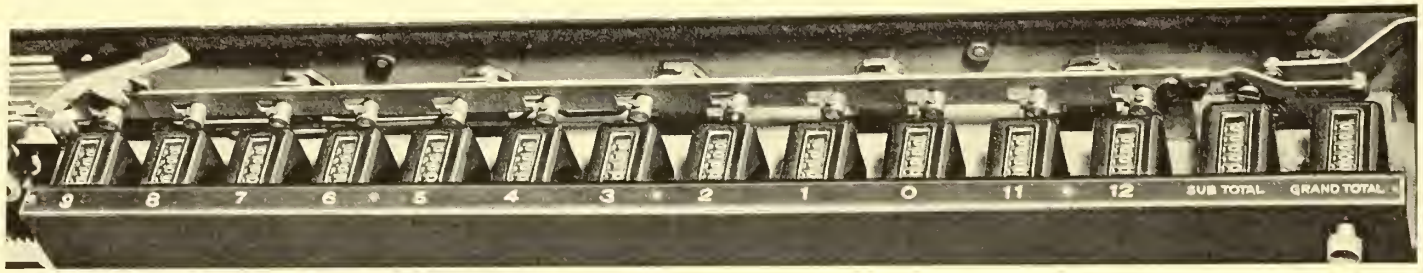
NUMBER OF CARD COUNTERS—14 As follows: one for each receiving magazine from 0 to 12 inc. One (1) for sub totals and one (1) for grand totals.

AUTOMATIC STOPPING DEVICE—For each of the 13 magazines.

CARD JAM SHUT-OFF—Automatic.

UNIVERSALITY—Will sort and count either 45 column cards—90 column cards or both.

COLOR—Black with gold striping.



The above illustrates the type of counters used on the Powers Counting Sorter.
Each counter is distinctly identified with the number
of its corresponding receiving magazine.

P78 PRINTED IN U S A.—2M 4 34

NEW PRODUCTS
and
PRODUCT DEVELOPMENT SERIES

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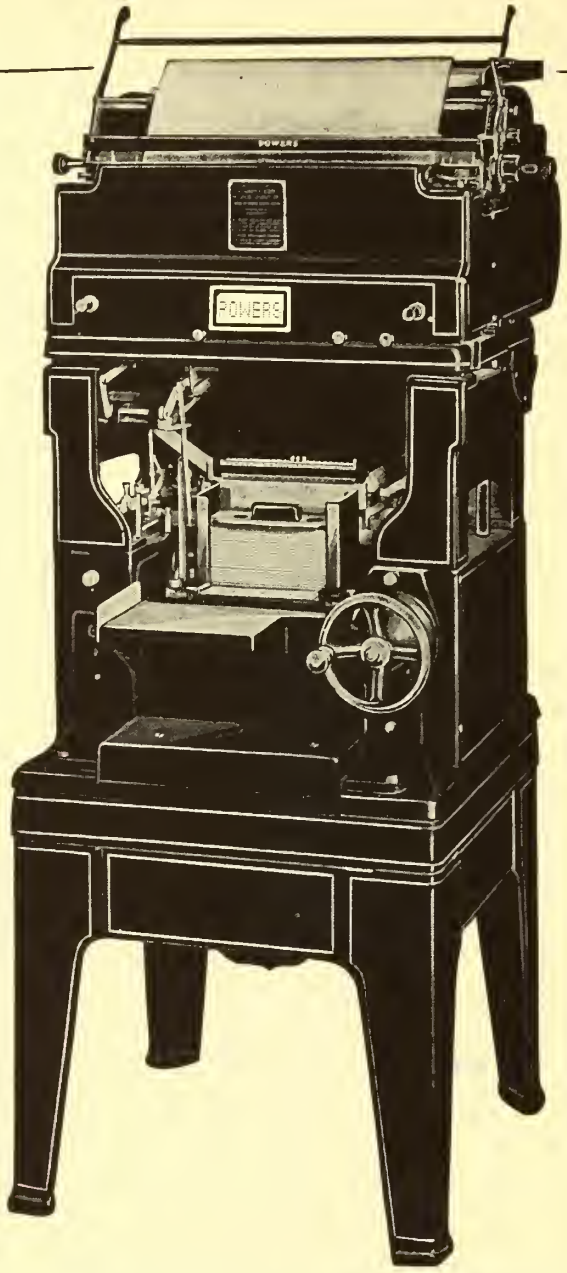
REMINGTON RAND
POWERS
NUMERICAL TABULATOR (45 Column)

BULLETIN
T-1

Remington Rand Inc.
Powers Accounting Machine Division
BUFFALO, N. Y.



POWERS NUMERICAL TABULATOR

(45 COLUMN)

THE Powers Numerical Tabulator pictured above has been designed to tabulate from Powers cards of 45 column capacity.

Information of a numerical character punched into Powers cards is translated and printed by this machine in any statement form desired. The tabulator will not only perform automatically the operations of adding and subtracting, but will produce sub and/or grand totals, whenever desired. Grand totals accumulated in the same unit or units with sub totals are printed directly under the latter.

This tabulator like other Powers tabulators is fully automatic. The only clerical attention necessary is the insertion of cards and forms—operations that may be performed easily and quickly even while the machine is running. Continuous form sheets such as fanfold or flat-pack paper may be used for tabulations just as well as cut forms.

POWERS NUMERICAL TABULATOR

(45 COLUMN)

OPERATING FEATURES AND ADVANTAGES

1. Proper Design

This tabulator (and all other types of Powers tabulators) is designed for the operator's convenience in every respect—card feeding, form feeding, starting, and stopping. All controls necessary to the operation of the machine—at the front.

2. Proper Printing Height

Printing is performed at an ideal height. No fatiguing posture required to observe the tabulated results. The height from the floor to the printing line is 50½".

3. Multiple Translators

This type of tabulator (like all other types of Powers tabulators,) is equipped with multiple translators. Therefore, one set-up whether simple or intricate, may be changed to another in less than half a minute. There is no need to wire each column individually; no wiring for control purposes; no wiring nor the setting of dials and special switches for adding or subtracting. The insertion of the multiple translator accomplishes *all* in a small fraction of a minute.

4. Compact

The machine itself occupies less than six square feet of floor space.

5. Constant Speed

Whether listing each item, running for totals only, subtracting, obtaining grand totals—the speed is constant and the same speed maintains even though this type of tabulator is used in conjunction with the Powers Summary Punch.

6. Direct Subtraction

Direct subtraction may be obtained up to a maximum of five units. The results of subtraction, in positive figures, is obtainable in the same column or unit in which the details appear—or in other units if and as desired. (See Bulletin T-3).

7. Grand Totals

Grand totals may be obtained up to a maximum of six units. A grand total usually appears in the same unit or column as sub totals. But grand totals may also be obtained in other units than those in which sub totals appear by the use of Y wires. (See Bulletin T-4).

SPECIFICATIONS

SPACE OCCUPIED—28"x30".

HEIGHT—54".

WEIGHT—530 lbs.

WORKING AREA—6' 4"x7' 6".

SPEED—100 cards per minute.

MOTOR SIZE—¼ H. P.

CURRENT—Either A. C. or D. C.

OPERATION—Automatic.

CARRIAGE—Standard 20", with inject mechanism. Maximum throw 8". Special 28" carriage also available.

TYPE OF TABULATING CARD EMPLOYED—45 column.

ARRANGEMENT OF UNITS—7 units of 10 sectors each.

GRAND TOTALS—Obtainable in 1, 2, 3, 4, 5 or 6 units.

HEIGHT FROM FLOOR TO PRINTING LINE—50½".

DIRECT SUBTRACTION—Obtainable in 1, 2, 3, 4, or 5 units.

FEEDING MAGAZINE CAPACITY—600 cards.

RECEIVING MAGAZINE CAPACITY—1000 cards.

CARRIAGE SPACING—Single, 6 lines to the inch; double, 3 lines to the inch.

TYPE OF PAPER—Cut, flat-pack or other types of continuous forms.

CARBON COPIES—Up to 6 legible copies.

FRACTIONAL SECTORS—For printing and accumulating eighths and twelfths.

SPECIAL ATTACHMENTS—Following special attachments obtainable; split unit device, card counter, variable automatic stopping device, special type, compensating or constant spacing carriages.

COLOR—Black with gold striping.

COMPARATIVE STATEMENT
ACTUAL EXPENSES WITH BUDGET

ACTUAL LESS THAN BUDGET— *
ACTUAL GREATER THAN BUDGET— OV

TERRITORY New England

PERIOD July

		ACCOUNT NUMBER	LOCATION	CURRENT MONTH BUDGET	CURRENT MONTH ACTUAL EXPENSE	CURRENT MONTH OVER OR UNDER (ACTUAL COMPARED WITH BUDGET)	YEAR TO DATE BUDGET	YEAR TO DATE ACTUAL EXPENSE	YEAR TO DATE OVER OR UNDER (ACTUAL COMPARED WITH BUDGET)	✓
Field Sales Office (Control Account)	3200									
Salaries—Sales Manager and Assistants	3201	3201	51	900 00	950 33	50 33 OV	4 500 00	4 534 33	34 33 OV	
Salaries—Clerical	3202	3202	51	2 350 00	2 102 13	247 87 *	11 750 00	11 325.83	424 37 *	
Occupancy Expense	3203	3203	51	875 00	910 20	35 20 OV	4 375 00	4 405 78	30 78 OV	
Travelling Expense	3204	3204	51	600 00	735 16	135 16 OV	3 000 00	3 145 42	145 42 OV	
Stationery and Supplies	3205	3205	51	37 00	48 23	11 23 OV	185 00	170 21	14 79 *	
Postage	3206	3206	51	17 00	16 54	48 *	85 00	81 41	3 59 *	
Telephone	3207	3207	51	25 00	31 86	6 86 OV	125 00	128 15	3 15 OV	
Telegraph	3208	3208	51	50 00	47 18	2 82 *	250 00	235 88	14 34 *	
Depreciation—Furniture & Office Equipment	3209	3209	51	164 00	172 12	8 12 OV	820 00	818 71	3 29 *	
Insurance—Furniture Office Equipment	3210	3210	51	85 00	76 81	8 19 *	425 00	395 14	29 86 *	
Maintenance—Furniture & Office Equipment	3211	3211	51	10 00	7 11	2 89 *	50 00	32 10	17 90 *	
Entertaining	3212	3212	51	50 00	98 13	48 13 OV	250 00	267 28	17 28 OV	
New Business Expense	3213	3213	5	125 00	213 22	88 22 OV	825 00	875 13	50 13 OV	
Membership Dues—Associations	3214	3214	51	38 00	29 68	6 32 *	180 00	160 68	19 32 *	
Surety Bond Expense	3215	3215	51	11 00	13 45	2 45 OV	55 00	61 22	6 22 OV	
Donations and Subscriptions	3216	3216	51	25 00		25 00 *	125 00	75 15	49 85 *	
Sample Expense	3217	3217	51	65 00	36 16	28 84 *	325 00	285 84	39 38 *	
Sales School	3218	3218	51	175 00	35 43	139 57 *	875 00	745 22	129 78 *	
Bonuses Paid	3219	3219	51	300 00	132 98	167 02 *	1 500 00	1 206 08	293 92 *	
Commissions Paid	3220	3220	51	900 00	1 018 54	116 54 OV	4 500 00	4 983 64	483 64 OV	
Prizes	3221	3221	51	50 00	46 10	3 90 *	250 00	189 12	60 88 *	
General and Unclassified	3222	3222	51	300 00	314 22	14 22 OV	1 500 00	1 584 53	84 53 OV	
Proportion of Administrative Office	3223	3223	51	1 100 00	1 347 32	247 32 OV	5 500 00	5 734 22	234 22 OV	
Salaries of Salesmen	3224	3224	51	4 800 00	4 675 66	124 34 *	24 000 00	21 350 67	2 649 33 *	
Drawing Account Debits—Write-off	3225	3225	51	300 00	422 16	122 16 OV	1 500 00	1 761 89	261 89 OV	
Budget Grand Totals				13 350 00			66 750 00			
Expense Grand Totals					13 476 54 GT			64 330 61 GT		

SAMPLE TABULATION PREPARED ON POWERS NUMERICAL TABULATOR

THE above Comparative Statement was prepared on the Powers Numerical Tabulator (Model 2) equipped with two units of direct subtraction. In this particular illustration, the actual expenses for the current month have been automatically subtracted from the budget figure and the net difference—Over or Under—shown in its own column position opposite its respective account number. Also with respect to year-to-date, the actual expenses have at the same time been automatically subtracted from the year-to-date budget and the difference—Over or Under—shown in the last column. The star following the amount indicates that the actual expenses are less than budget. When greater than budget, the symbol "OV" in this particular tabulation follows the number.

It is a particularly interesting fact that in the illustration above, all amounts appearing in the six columns resulted from information punched in but *two* fields of the Powers card form. Among other things, the above illustrates what is known as *horizontal* direct subtraction—the minuend in one unit, the subtrahend in a second unit, and the difference in a third unit. As indicated under "Operating Features and Advantages," vertical subtraction also may be obtained by the use of Powers direct subtraction units.

P47B—PRINTED IN U. S. A.—2500-1-36

NEW PRODUCTS
and
PRODUCT DEVELOPMENT SERIES

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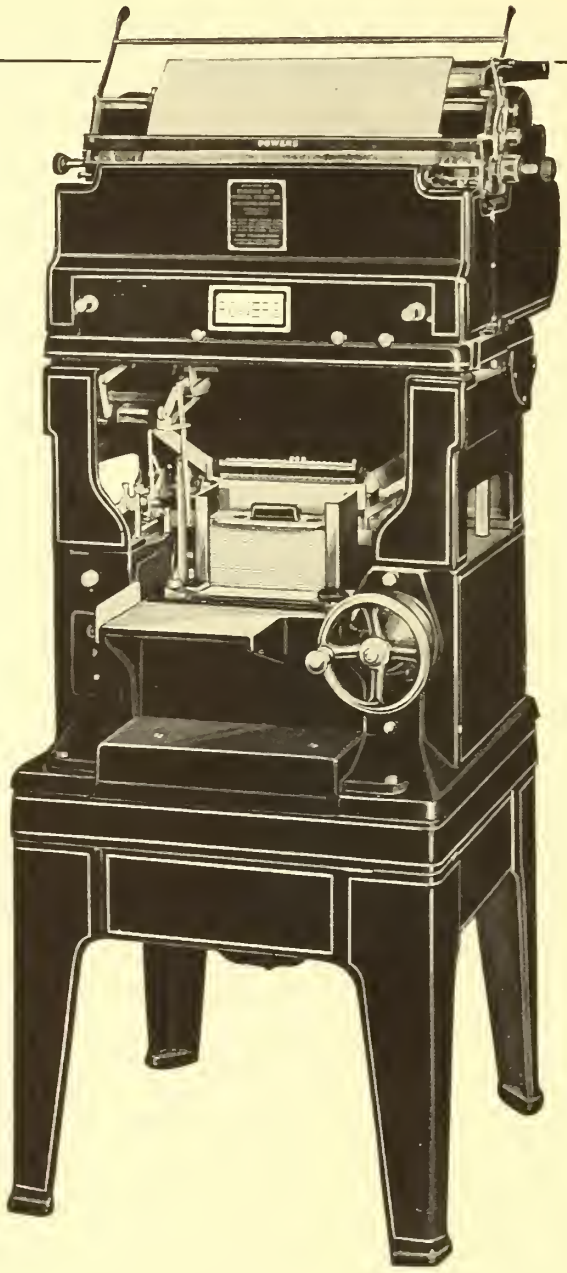
POWERS 90-COLUMN TABULATOR

NUMERICAL—10 SECTOR UNITS

BULLETIN
T-2

POWERS ACCOUNTING MACHINES
DIVISION OF REMINGTON RAND INC.
Buffalo, N. Y.



POWERS 90 COLUMN TABULATOR

NUMERICAL—10 SECTOR UNITS

THE Powers 90 Column Tabulator has been designed to tabulate from Powers cards of not only 90 column but also of 45 column capacity. It is because of the former feature that this machine is called the Powers 90 Column Tabulator.

Information punched into Powers cards is translated and printed by this machine in any statement form desired. This type of tabulator will perform automatically the operations of adding and direct subtracting and will produce sub or grand totals, or both, whenever desired. The printing capacity of the machine is in no way affected when grand totals, in addition to sub totals, are obtained. Grand totals are printed directly under the sub totals.

This tabulator, like all other Powers tabulators, is fully automatic. The only clerical attention necessary is the insertion of cards and forms—operations that may be performed easily and quickly even while the machine is running. Continuous form sheets may be used for tabulations just as well as cut or flat-pack paper.

POWERS 90 COLUMN TABULATOR

OPERATING FEATURES AND ADVANTAGES

1. Proper Design

This tabulator (and all other types of Powers tabulators) is designed for the operator's convenience in every respect—card feeding, form feeding, starting, and stopping. All controls necessary to the operation of the machine—at the front.

2. Proper Printing Height

Printing is performed at an ideal height, from floor to the printing line is 50½".

3. Universality of Machine

Not only is this tabulator designed to accommodate 90 column cards but also 45 column cards.

4. Multiple Translators

This type of tabulator (and all other types of Powers tabulators) is equipped with multiple translators. Therefore, a series of "set-ups" whether simple or intricate may be completely made in a few seconds. One translator will of itself serve a plurality of applications—enough in most instances to satisfy the most exacting requirements of the average installation. This is possible because the Powers Multiple Translator is built with such a large factor of capacity. There is no need of wiring each column individually; no wiring for control purposes; no wiring for adding or subtracting. The insertion of a multiple translator accomplishes all in a small fraction of a minute.

5. Compact

The machine itself occupies less than 6 square feet of floor space.

6. Constant Speed

Whether listing each item, running for totals only, subtracting, or obtaining grand totals—the speed is constant. The same speed maintains even though this type of tabulator is used in conjunction with the Powers Summary Punch.

7. Direct Subtraction

Up to four units of direct subtraction is obtainable. The result of subtraction is obtainable in the same column or unit in which the details appear—or in another unit if desired. (See bulletin T-3).

8. Grand Totals

Grand totals are obtainable in any four units. Grand totals usually appear in the same units or columns as sub totals. If desired, however grand totals may be obtained in units other than those in which sub totals appear. This is accomplished by the use of Y wires. (See bulletin T-4).

SPECIFICATIONS

SPACE OCCUPIED—28"x30".

HEIGHT—54".

WEIGHT—530 lbs.

WORKING AREA—6' 4"x7' 6".

SPEED—100 cards per minute.

MOTOR SIZE—¼ H. P.

CURRENT—Either A. C. or D. C.

OPERATION—Automatic.

CARRIAGE—Standard 20", with inject mechanism. Maximum throw of 8". Special 28" carriage also available.

TYPE OF TABULATING CARD EMPLOYED—45 column, 90 column, and combination.

KIND—Numerical.

ARRANGEMENT OF UNITS—7 units of 10 sectors each.

GRAND TOTALS—Obtainable in 1, 2, 3, or 4 units.

HEIGHT FROM FLOOR TO PRINTING LINE—50½".

DIRECT SUBTRACTION—Obtainable in 1, 2, 3, or 4 units.

FEEDING MAGAZINE CAPACITY—600 cards.

RECEIVING MAGAZINE CAPACITY—1,000 cards.

CARRIAGE SPACING—Single,—6 lines to the inch, double—3 lines to the inch.

TYPE OF PAPER—Flat-pack, cut or continuous form.

FRACTIONAL SECTORS—For printing and accumulating eighths and twelfths.

SPECIAL ATTACHMENTS—Following special attachments obtainable: Split unit device, card counters, variable automatic stopping device, special type.

CARBON COPIES—Up to 6 legible copies.

COLOR—Black with gold striping.

EXAMPLES OF POWERS CARDS USED WITH THE POWERS 90 COLUMN TABULATOR

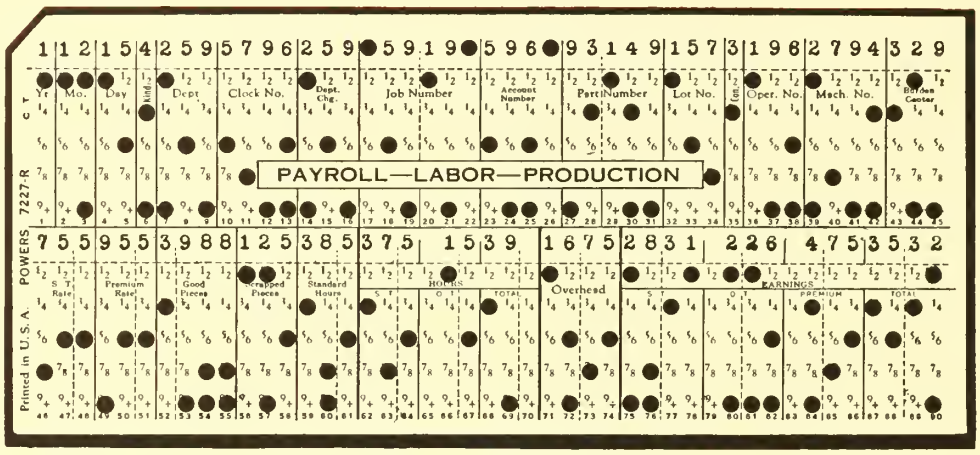


FIG. I. 90 COLUMN CARD WITH INTERPRETATIONS

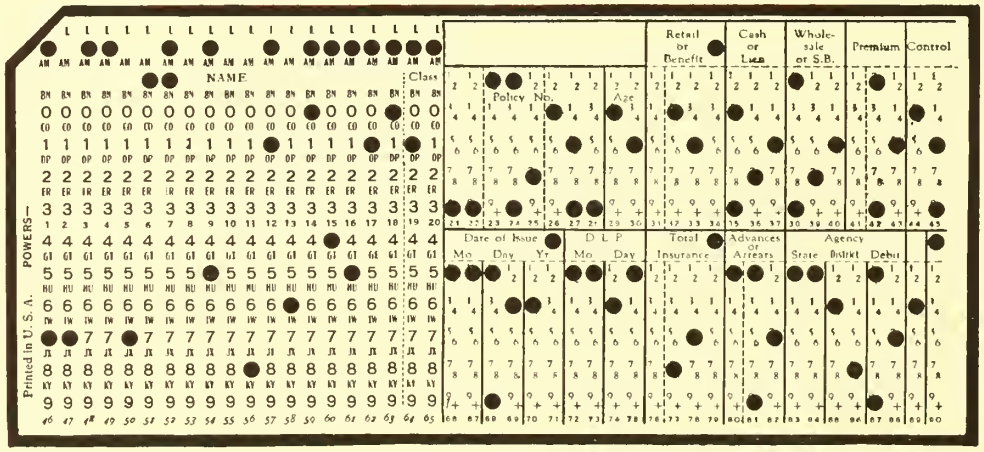


FIG. II. 90 COLUMN CARD WITH ALPHABETIC FIELD

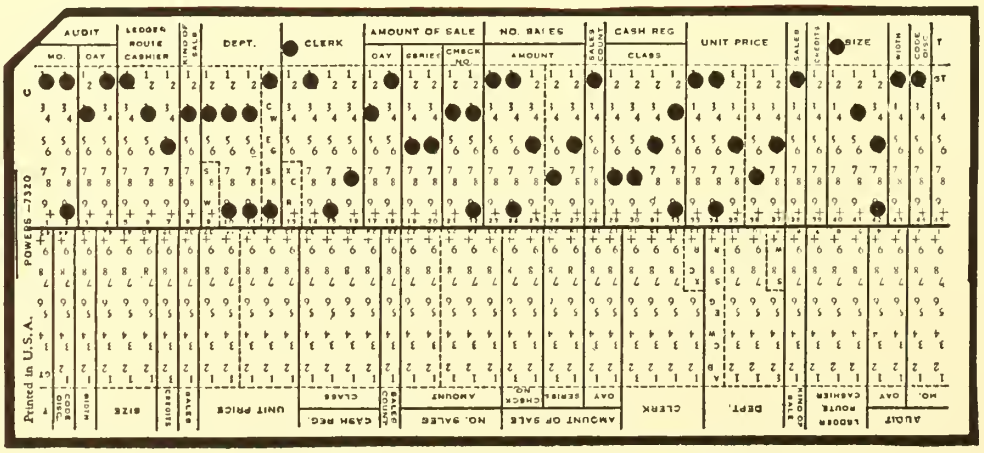


FIG. III. 90 COLUMN CARD IN "TIP OVER" ARRANGEMENT

P48A PRINTED IN U. S. A.—3M-1-35

NEW PRODUCTS

and

PRODUCT DEVELOPMENT SERIES

This series of bulletins of which the present is a part has for its objective the furnishing of authoritative information with respect to the mechanical specifications and operating advantages of all new products and the further development of present products.

POWERS

SUMMARY CARD PUNCH

BULLETIN
P-4

POWERS ACCOUNTING MACHINES
DIVISION OF REMINGTON RAND INC.
Buffalo, N. Y.

POWERS SUMMARY CARD PUNCH

THE Summary Card Punch "hooked-up" to the Tabulator performs the function of punching automatically summary cards, or group total cards, for those designated classifications summarized on the tabulator. It operates to produce automatically a punched tabulating card for each group total printed by the tabulator. Not only are summarized amounts punched through this means but also all designating data. Thus a summary card "summarizes" any number of detailed cards automatically while the tabulator is in operation with the result that month-end peak loads may be overcome. Due to its design, the punching of a summary card does in no way slow, retard, or diminish the production of the Powers Tabulator,—an exclusive Powers feature.

OPERATING FEATURES AND ADVANTAGES

1. Synchronized Control.

Through the means of a small knob on the left side of the tabulator, the operator may make the summary card punch operative with the tabulator, or inoperative, as desired.

2. Production of Tabulator Constant.

One of the outstanding features of this type of punch is that its use does *in no way* retard or slow up the production of the tabulator. Whether the data to be summarized requires one or all columns in the summary card, or whether there are long or short-run totals, the summarizing of these variable conditions in no way reduces the normal production of the tabulator. The summary card is completely punched (all holes at the same moment rather than column by column) instantly upon the printing of a total by the tabulator. Powers Summary Card Punch is the only punch having this exclusive, important and time-saving feature.

3. Summary Cards for Group and Grand Totals.

Not only may summary cards be obtained for group totals (or sub-totals as they are often called) but also for grand totals.

4. Transposed Summarization.

The summarized amounts and related designating data need not appear in fields of the summary card which correspond, column for column, with the fields of the detail cards. Nor is it necessary that the amounts and related designating data as punched in the summary card be in the same order of arrangement as they appear on the tabulated sheet. Through the use of removable translators (exclusive with Powers) in the Summary Card Punch, summary amounts and designating data may be punched in any card field as desired and in any arrangement, irrespective of the design of the detail card or the arrangement of the printing on the tabulated sheet.

5. Complete Summarization.

The Summary Card Punch permits complete summarization. This means that there is no limit set upon the number of columns of designating information that may be transferred to the summary card. Whatever may be printed on a tabulated sheet or form by the tabulator may be made to appear in the summary card.

6. Partial Summarization.

It is not necessary that all amounts nor all designating data appearing on the tabulated sheet be punched in the summary card. The Summary Card Punch through its translator and controls permits just so much of the information to appear in the summary card as the user desires. This is known as Partial Summarization.

7. Recurrent Summarization.

Powers summary cards may be used more than once. Against a certain classification, for example, the accumulated or summarized amount for one month may be punched in the summary card in one field, for the following month in another field of the same summary card, and so on. This is known as recurrent summarization and is made possible in this machine.

8. Selective Summarization.

Under "Synchronized Control" above, mention was made of the control which permits the operator to make operative the summary card punch with the tabulator, and when inoperative. This feature permits selective summarization. Thus at the election of the operator, summary cards may be produced, when and as desired, during different card runs or during the same card run.

9. Duplicate Summarization.

In certain instances it may be necessary or desirable to have the same summarized amount (or group total) appear in more than one field of the summary card. This is made possible through the use of the Summary Punch Translator.

10. Addition and/or Subtraction Summarization.

Another feature of the Summary Card Punch permits the punching of an amount in the summary card representing the sum of a number of debit amounts of *like* character in the detail cards, and also the *difference* between debit and credit amounts of *unlike* character. Thus the summary card punch may be used when direct subtraction units are incorporated in the Powers Tabulator. And further, during the same run of cards, the summary of plus amounts in one field of the detail cards may be summary punched at the same time and in the same summary card as the summary (of differences) is punched in another field of the summary card for both plus and minus amounts appearing in *another* field of the detail cards.

11. Debit and Credit Summarization.

In connection with subtraction summarization, the excess of debits over credit amounts may be summary punched together with an indicating control hole that the amount does represent an excess of debits. Likewise the excess of credits over debits may be summary punched with designating control holes making the amount so punched a credit or subtracting (or adding if so desired) amount for subsequent accounting.

12. Repeat Summarization.

It may be desirable at times to punch certain repeat information into the summary card which information does not appear either in the detail cards or on the printed tabulation. This may be accomplished by setting up the necessary information in the Summary Card Punch through the use of repeat slides.

SPECIFICATIONS

WEIGHT—386 lbs.
HEIGHT—60".
MOTOR SIZE—1/6 H. P.
CURRENT—Either A. C. or D. C.
SPACE OCCUPIED*—2' 3½"x5' 10¾".
WORKING AREA*—6'x10'.
MAGAZINE CAPACITY—Feeding—600 Receiving—600.

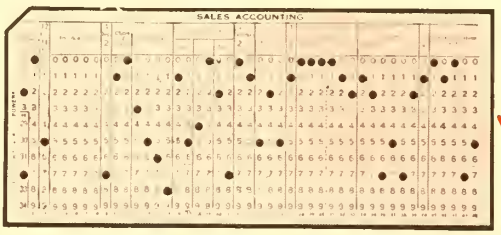
*Includes tabulator to which hooked up.

FEED MAGAZINE CONTROL—Automatic shut-off when magazine becomes empty.

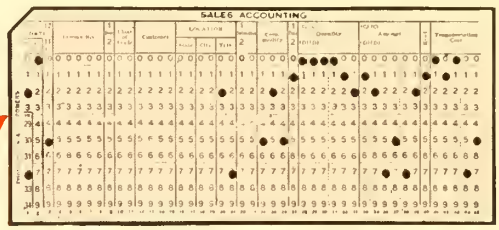
COLOR—Black with gold striping.

UNIVERSALITY—Numerical or alphabetical cards either 45 or 90 column; complete, partial, recurring, duplicate, transposed, subtraction, debit and credit summarization and repeat summarization available with each style and type of Powers Tabulator.

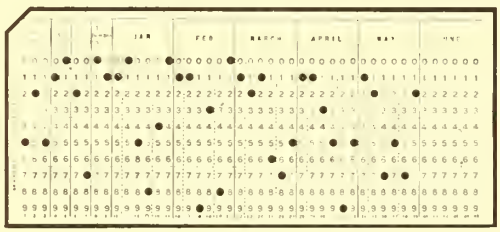
EXAMPLES OF POWERS SUMMARY PUNCHING



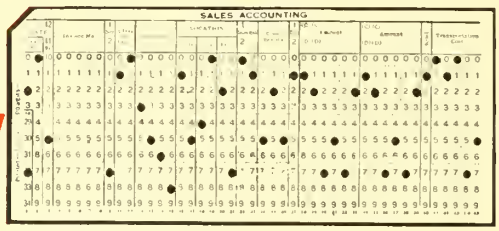
Complete Summarization



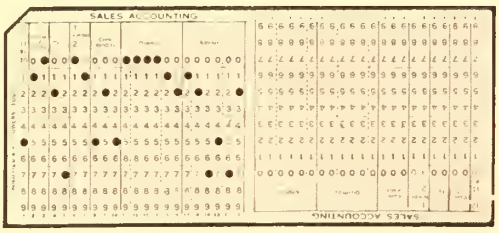
Partial Summarization



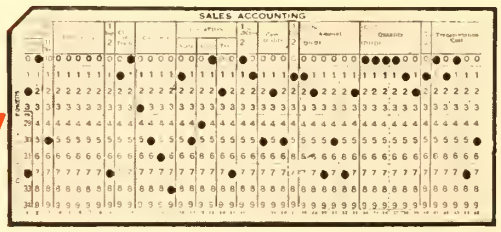
Recurrent Summarization



Duplicate Summarization



Summarization on Tip-Over Card



Transposed Summarization

SALES ACCOUNTING

PERIOD MAY

MONTH	TERRI-TORY	SALESMAN	COMMODITY	QUANTITY	AMOUNT	TRANSPORTATION
5	27	1	525	[illegible]	1 275 72 •	10 75 •
5	27	1	528	140 •	687 90 •	5 55 •
5	27	1	573	20 •	560 00 •	8 27 •
5	27	1	595	14 •	372 69 •	12 60 •
5	27	1	602	175 •	3 172 50 •	9 72 •
				361 GT	6 068 81 GT	132 89 GT
5	27	2	525	9 •	962 87 •	9 60 •
5	27	2	573	20 •	560 00 •	5 78 •
5	27	2	594	79 •	389 72 •	10 20 •
5	27	2	615	65 •	5 171 65 •	172 15 •
				173 GT	7 084 24 GT	197 73 GT

P30B PRINTED IN U. S. A. 3M-8-34

Limnekin

Scope of punched card accounting

DATE	ISSUED TO
4/10	
6/35	Edelstein